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THIRD SERIES FOUNDED BY EDWARD JACKSON

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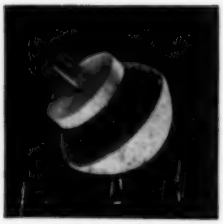

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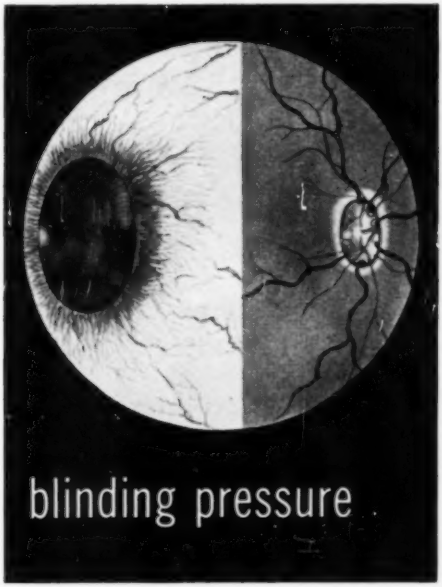

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The two best methods of restoring binocular vision in these cases are the use of either the catmin lens or the use of contact lenses. Both of these methods have been described in earlier Scientific Corners. Another method sometimes successful, very often not, is to let the patient use one eye for reading and the other eye for distance. This scheme does not always work and cannot be compared in results to the use of the catmin lens or contact lenses.

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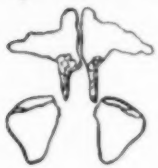

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THERAPEUTIC RESULTS IN ADVANCED CHRONIC SIMPLE GLAUCOMA WITH TELESCOPIC FIELDS*

SYLVAN BLOOMFIELD, M.D., AND LEO KELLERMAN, M.D.
New York

In the treatment of chronic simple glaucoma it is generally accepted that surgery is indicated when medical therapy proves unsatisfactory. Reese[1] and, more recently, Kronfeld and McGarry[2] have demonstrated statistically that such operations are most successful early in the course of the disease, and that the results of surgery on eyes with advanced glaucomatous damage are generally poor. This is in agreement with the opinion expressed by Gradle[3] and others, that operation on an eye with advanced glaucoma is extremely hazardous.

Another observation concerning eyes in an advanced stage of glaucoma is of interest. Reese, in a footnote appended to his paper,[1] noted that such eyes, when reduced to telescopic fields, often seemed to retain central vision for long periods although their ocular tension might be uncontrolled. Kronfeld and McGarry[2] have stated that "it seems highly probable, however, that the chances of survival of the center of the field are not much poorer under nonnormalization than under normalization of tension."

If it is true that glaucomatous eyes with markedly restricted central fields retain their residual function in spite of elevated tension, and that operations for reducing tension in such eyes are dangerous, it would seem that surgery in these cases may acually be contraindicated. Such a conclusion, however, is opposed to the widespread opinion that in any eye an abnormally high intraocular pressure that does not respond to medical therapy should be treated surgically. The purpose of this paper is to evaluate statistically the advisability of surgical intervention in eyes reduced to telescopic fields by advanced chronic simple glaucoma that is medically uncontrolled.

For this study, the course of a series of unoperated eyes with advanced chronic simple glaucoma was investigated. Only those eyes were considered that had central fields reduced in all isopters to 10 degrees or less from fixation at their widest meridian. These fields were all measured on the tangent screen at one meter, with standard-sized objects. A few eyes were included in this group in which, in addition, small temporal islands of field were present but completely separated from the central field by at least 10 degrees. In none of these eyes was vision reduced to less than 20/200. This limit was decided upon so that later decreases in vision might be readily detected. Finally, all of the eyes included in this study showed tensions of over 35 mm. Hg (Schiøtz), on three or more occasions, to indicate the inadequacy of medical treatment in each case. The problem such uncontrolled tension presented was met in certain of these cases by resort to surgery, and in other instances simply by continuation of miotic therapy. A comparison of the results of each of these methods of treatment is the basis of this study.

The records employed for this investigation were obtained from the ward services of

* From the Ophthalmological Services of Dr. Willis S. Knighton, The New York Eye and Ear Infirmary; and of Dr. R. Townley Paton, The Manhattan Eye, Ear, and Throat Hospital.

two large metropolitan ophthalmic hospitals whose files for the past eight years were reviewed. All eyes that fulfilled the above criteria were considered for this study. However, since relatively few eyes fulfilled all these conditions and since the records of many otherwise eligible cases were not sufficiently complete for critical evaluation, only 41 eyes were found suitable for consideration.

Of these 41 eyes, 19 subsequently underwent surgery to relieve a recurrently high tension that did not respond to miotic therapy. The remaining 22 eyes were not operated upon, although the tension in each case was inadequately controlled medically according to the criteria outlined above. The range of ages of the patients in the operated group was from 30 to 77 years, and averaged 62 years. The ages of the patients in the unoperated series was from 38 to 79 years, and averaged 65 years.

The preoperative visual acuities in the operated eyes ranged from 20/30 to 20/200. Of the 19 eyes in this group, 11 had vision of better than 20/70, and 8 had visual acuities of 20/70 or less before operation. The range of visual acuity in the 22 eyes that were not operated upon was from 20/30 to 20/200. Of these, 11 had visual acuities of better than 20/70, and 11 had acuities of 20/70 or less, at the beginning of the period under consideration in this study.

The range of tension in the eyes in each series at the beginning of this period was also quite similar. Thus the conditions of the eyes in each of these two groups, before surgery was applied to one of them, were sufficiently alike to permit a valid comparison of the results of alternative methods of therapy.

In evaluating the results of surgery, only the response to the first operation was considered in those three cases where several procedures were performed. The follow-up period under consideration was terminated before the second operation on these eyes, to permit attention to be focused in this study on the results of a single operation in these late glaucomatous eyes rather than on the cumulative traumatic effects of many surgical procedures. However, the occurrence of postoperative complications did not exclude any eye from consideration inasmuch as they were considered relevant to the problem of determining the hazards such surgery entails. The operations done comprised 5 Elliot trephining operations, 2 modified Lagrange operations, 1 basal iridectomy, 8 iridencleisis operations, 2 iridencleisis with sclerectomy procedures, and 1 cyclodiathermy operation.

In evaluating the results of the treatment of these eyes, it was felt that the primary consideration was the eventual effect on visual acuity. Since all the eyes under consideration had initial fields limited to 10 degrees or less from fixation, further field restrictions would frequently have been difficult to distinguish and certainly, from the patient's point of view, would be far less important than the actual vision retained. All visions were recorded with refractive correction where so improvable.

It was usually very difficult to establish accurately the exact cause for the reduction in visual acuity that occurred in many of these eyes. Therefore, no attempt was made in this investigation to determine to what degree visual loss was due to cataractous changes in the lens, progressive neuroretinal degeneration, or vascular pathologic conditions. It seemed valid to assume that in these two series of similar eyes the incidence of such senile and glaucomatous pathologic processes would be statistically equivalent except for the surgery performed on one group, which would affect ocular structures, and the subsequent course of the glaucoma, only in the operated series.

Study of operated eyes

Of the 19 eyes operated upon, 11 (58 percent) showed some loss in visual acuity at the first postoperative examination, and that loss ranged from one line on the standard Snellen chart to loss of light perception, in

one case. From the point of view of useful vision, it may be noted that, whereas none of these 19 eyes preoperatively had less than 20/200 vision, the first acuity recorded postoperatively had fallen below this level in 6 (32 percent) of all these eyes.

The follow-up period for these operated eyes varied from 2 months, in one case that was reduced to perception of hand movements in that period, to 6 years. The average follow-up interval for the group was 2 years and 4 months. During this postoperative period, 11 of these 19 eyes showed satisfactory control of tension, as indicated by a tension range consistently below 35 mm. Hg (Schiøtz). In the remaining 8 eyes (42 percent) the tension remained uncontrolled postoperatively, even with supplementary medical treatment.

Although the follow-up period recorded for this operated series is not long, several interesting facts are revealed by a study of the visual status of these eyes at the end of that time. Thus, for the periods recorded, it is noteworthy that only 3 of these 19 eyes retained a visual acuity equal to that present preoperatively, and 16 (84 percent) of the total suffered some visual loss. In the latter group, 9 eyes or (47 percent) of the total number operated upon were reduced in visual acuity to less than 20/200 by the end of their follow-up period. Of these 9 eyes with markedly reduced vision, 6 were eyes in the group of 8 with tension uncontrolled postoperatively and the remaining 3 were among the 11 eyes whose tensions were apparently successfully controlled by operation. Thus, of the eyes whose tension was uncontrolled, 75 percent showed a loss of visual acuity to less than 20/200, and of the postoperatively controlled group, 27 percent showed such extreme loss in acuity.

The small number of cases operated upon does not permit many conclusions to be drawn from a more detailed analysis of these results. Although the two eyes with highest

Fig. 1 (Bloomfield and Kellerman). Summary of visual status of operated and unoperated eyes.

	OPERATED	UNOPERATED
TOTAL NUMBER OF EYES IN EACH GROUP	19	22
NUMBER OF EYES WITH INITIAL VISION OF BETTER THAN 20/70	11	11
NUMBER OF EYES WITH INITIAL VISION OF LESS THAN 20/70	8	11
AVERAGE FOLLOW-UP PERIOD	28 mos	24 mos
NUMBER OF EYES WITH SOME LOSS OF VISION AFTER FOLLOW-UP	16	8
PERCENTAGE OF EYES WITH SUCH LOSS	84%	36%
NUMBER OF EYES WITH VISION REDUCED TO LESS THAN 20/200 WITHIN FOLLOW-UP PERIOD	9	3
PERCENTAGE OF EYES WITH SUCH SEVERE VISUAL LOSS	47%	14%

preoperative tensions were respectively reduced in visual acuity from 20/30 and 20/40 to perception of hand movements and finger counting, such a possible relationship of high preoperative tension to poor postoperative result is not borne out in other cases. Similarly, there seemed to be no correlation of degree of loss of vision to the age of the patient. In general, the immediate postoperative loss of vision seems to have been less in those eyes which underwent iridencleisis, but too few operations of the different types were performed to permit comparison of the results of the various procedures done on these advanced cases of glaucoma.

To determine to what degree these surgical results were influenced by systemic diseases that might predispose to operative complications, the blood pressure and fasting blood sugar recorded in each case at the time of operation were noted. In none of the 17 patients that underwent surgery was vascular hypertension present. In 3 of the patients, a mild degree of diabetes mellitus was recorded.

Four eyes of these 3 diabetic patients were included in the operated group. Three of these eyes showed no immediate postoperative loss of vision, which, as demonstrated above, is a better immediate operative result than that which occurred in the group as a whole. During follow-up periods similar to those of other patients in this study, a drop in visual acuity to less than 20/200 occurred in 2 of these 4 eyes, or 50 percent. As was noted above, this severe degree of visual loss was recorded in 47 percent of the whole operated group. It would, therefore, seem that the presence of diabetes mellitus in 3 of the operated patients did not appreciably affect the statistical evaluation of surgical results in this series.

It also seemed desirable to estimate the possible influence on these results of the varying technical skills of different operators. All these cases were operated upon in 1 of 2 large metropolitan ophthalmic hospitals. Nine of these 19 eyes were operated upon by experienced ophthalmologists who were on the attending staffs of these institutions. The other 10 eyes were operated upon by resident physicians supervised and assisted in each instance by a member of the attending staff. An immediate loss of some visual acuity was noted postoperatively in 4 of the eyes operated upon by the residents, and in 7 of the eyes operated upon by the members of the attending ophthalmological staffs. After the follow-up periods noted, a drop in visual acuity to less than 20/200 was noted in 4 of the eyes operated upon by the residents, and in 4 of the eyes operated upon by members of the attending staffs. It would, therefore, appear that in this series, the operative results obtained by the residents was no worse than that obtained by the attending ophthalmologists, and that consequently the technical experience of the operators did not significantly affect the statistical results in this operated group of eyes.

Study of Nonoperated Eyes

Of the 41 eyes with telescopic fields due to advanced chronic simple glaucoma here studied, 22 eyes in 20 patients were not operated upon although their tensions were inadequately controlled by medical treatment, according to the standard previously noted. These cases were closely followed for periods ranging from 8 months to 5 years, and averaged a recorded course of slightly more than two years. This approximates the follow-up period recorded for the group of comparable eyes that were operated upon, as previously noted.

During these periods, in spite of apparently inadequate therapy limited to the local instillation of miotics, a reduction in vision of any degree was noted in only 8 (36 percent) of these eyes. This visual loss ranged from one line on the standard Snellen chart to loss of light perception, in one eye. In only 3 of these eyes, 14 percent of all the unoperated eyes, was the visual acuity reduced below 20/200. It may be recalled that in the

eyes that were operated upon, 84 percent showed some visual loss over a comparable follow-up interval and 47 percent of the whole operated group had visual acuities reduced below 20/200 during that time.

Initial and resulting vision

A correlation was sought between the initial visual acuity in each eye of the two series and the vision eventually present. Among the operated eyes, a reduction in vision of at least one line on the Snellen chart occurred with equal frequency in the group with preoperative vision of better than 20/70 and that with initial acuities of 20/70 or less. This was true both for the results found at the first postoperative examination of acuity and for those recorded after the stated follow-up periods. Of course, the occurrence of further visual loss resulted more frequently in disablingly low acuity in the group with initially poorer vision. Similarly, in the group of unoperated eyes, the incidence of further visual loss during the period of this study was not significantly different in those eyes with initial acuity of better than 20/70, than in those whose vision at the beginning of the period of observation was already reduced to 20/70 or less.

Configuration of central field

The possibility was also suggested that the configuration of the small central field present in these eyes at the beginning of this study might influence the eventual visual result in both the surgically and medically treated groups. The fields of all the eyes under consideration, although limited to those not greater than 10 degrees from fixation in all meridians, could be divided roughly into those which were round and those which were kidney-shaped. The latter configuration occurred in those eyes in which the nasal field was disproportionately constricted to fall within three degrees or less of the fixation point.

Among the 19 operated eyes, 9 fields were found to have been kidney-shaped in this way, preoperatively. Five of these eyes had visual acuities of better than 20/70, and 4 had vision reduced to 20/70 or less at the beginning of this study. Analysis of the effect of surgery on these eyes disclosed no significant difference in the incidence of reduced vision from that which occurred in the entire surgically treated group, either immediately after operation, or after the follow-up period. A reduction in visual acuity to less than 20/200 occurred in 44 percent of these eyes with kidney-shaped central fields; a result strikingly similar to the 47-percent incidence of such loss in the entire surgical group.

Among the 22 medically treated eyes, 8 presented kidney-shaped central fields as previously defined. Three of these eyes had visual acuities of better than 20/70, and 5 had vision of 20/70 or less. Under medical treatment that proved inadequate to control the tension, only 3 of these 8 eyes showed a further reduction in acuity during the follow-up period studied, and in only one instance did a loss of vision to less than 20/200 occur. The visual results in these eyes with kidney-shaped fields were, therefore, very similar to those which occurred in the medically treated group as a whole.

Comment

Although the number of eyes studied in each group is too small for detailed quantitative comparison of results, the grossly poorer visual status of the group of eyes that underwent surgery is striking. The immediate deleterious effect of operation on these very late cases of chronic simple glaucoma with telescopic fields is indicated by the early loss of some degree of acuity in 58 percent of these eyes. Over a follow-up period averaging over two years, this percentage of eyes with some visual loss postoperatively rose to 84 percent, and of the total number of operated eyes, 47 percent, or almost half, had suffered an extreme loss of vision to less than 20/200.

Contrasting results were presented by the

comparable group of eyes in which therapy was limited to miotic drops that proved inadequate to keep the tension within normal range. Of these, over a similar interval of time, 36 percent suffered some reduction in visual acuity, and in only 14 percent of this entire unoperated group was the loss of vision so severe as to reduce acuity to less than 20/200.

The reason for the unfavorable visual results following surgery in these cases is not clear. Certainly the restoration of normal tension to a glaucomatous eye would seem to be desirable in any stage of the disease. Nevertheless, in this series of cases of advanced glaucoma with marked field restriction, even operations that succeeded in controlling tension eventually resulted in a reduction in vision to less than 20/200 in 27 percent of the cases. In the 42 percent of cases in which operation failed to control tension, the incidence of such disabling loss in vision was 75 percent. In comparable eyes in which the tension was permitted to remain abnormally high by limiting therapy to local medication, such extreme loss was recorded in only 14 percent.

This suggests the possibility that, in advanced cases of chronic simple glaucoma, a functional equilibrium is attained that permits the retention of central vision in spite of abnormally high tensions over relatively long periods. Surgery apparently entails the hazard of disturbing this balance so that further loss of visual function is more likely to occur after operation even if the intraocular pressure is subsequently adequately controlled. When operation does not succeed in reducing ocular tension to normal range, as is common in these late cases, the disturbed functional balance plus continued tension elevation results in an extremely high incidence of severe visual loss.

Whatever the underlying cause may be, the facts here presented suggest that eyes with telescopic fields due to advanced glaucomatous damage tend to retain a useful degree of central vision for relatively long periods with simple medical treatment although tension may not be controlled. In such eyes, surgery employed to reduce the tension involves a significantly greater risk of incurring visual disability than does the continuation of apparently inadequate tension control through miotic therapy alone.

Conclusion

A study was made of the treatment of 41 eyes with uncontrolled chronic simple glaucoma sufficiently advanced to produce a constriction of central fields to 10 degrees from fixation.

In 19 of these eyes, surgery was performed to reduce the tension, with subsequent loss of some visual acuity in 84 percent of these cases, and a reduction in acuity to less than 20/200 in 47 percent, over a follow-up period averaging a little over two years.

In the remaining 22 eyes, the tension remained above normal range but no surgery was performed. In this group, over a comparable period, some visual loss occurred in 36 percent, and an extreme reduction in acuity to less than 20/200 in 14 percent.

These facts suggest that in eyes with advanced chronic simple glaucoma of this degree, central vision may be retained for long periods in spite of inadequately controlled tension, and that in such cases operation to reduce the tension is contraindicated.

1010 Fifth Avenue (28).
1095 Park Avenue (28).

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CATARACT AND TETANY PRODUCED BY PARATHYROID DEFICIENCY DURING PREGNANCY, LACTATION, AND MENSTRUATION*

DONALD J. LYLE, M.D.
Cincinnati, Ohio

INTRODUCTION

Parathyroid deficiency may be classified according to its etiology into that produced by

1. Operative damage.
2. Intrinsic impairment from disease, or degeneration, or lack of development of the glands.
3. Extrinsic factors demanding immoderate function of the normal glands such as (a) Low calcium intake; (b) Depletion from conditions destroying calcium or demanding it in excess.
4. Not determined, unknown or idiopathic.

Last year was presented a case history and discussion of cataract and papilledema in parathyroid deficiency resulting from operative damage. This year I should like to present a case history of idiopathic parathyroid deficiency and discuss the effect upon it of pregnancy, lactation, and menstruation.

CASE REPORT

A white woman, aged 28 years, presented herself for examination because of failing vision in both eyes. Discrete opacities of various densities were found beneath the posterior capsule of both lenses, with a few raylike riders arching through the periphery to the anterior subcapsular area. This type of bilateral cataract in a young adult was immediately suggestive of endocrine disturbance.

The history prior to the beginning of diminished vision was irrelevant. There were no illnesses of severe nature, no operations, and the family history was entirely without pertinent disclosure. The loss of sight began gradually during the first pregnancy and increased with lactation and a subsequent pregnancy. Finally, with menstruation, the vision became more disturbed.

Positive Chvostek's and Trousseau's signs and a low serum calcium of 7 mg. per 100 cc. of blood established the diagnosis of idiopathic parathyroid deficiency. The patient was sent for further laboratory tests and X-ray studies and was given a note to her physician stating the diagnosis and suggested treatment. She was asked to furnish a brief account regarding the onset and development of her symptoms. The following is from her letter:

"This eye condition started in the spring of 1943, shortly after I became pregnant. It was more noticeable when I tried to read. I nursed my first child for seven months and during that time noticed that the vision in my left eye was quite blurred. An eye doctor was consulted and he prescribed tinted lenses. To my recollection I noticed nothing until a month after I became pregnant with my second child, in December, 1945. The vision becoming worse, I consulted another doctor who told me I had an opacity in the back of my left lens, which might get better or worse. My sight became progressively worse with each month of pregnancy, although I could still read without much strain.

"As I look back on it now, with both pregnancies I was extremely nervous and despondent, with a constant twitching of the muscles of my hands and feet and one muscle in my stomach. I suffered with many leg cramps and rheumatism.

"I nursed my second child for four months until I noticed an increasing difficulty in reading. I then went to another doctor, who

* Presented at the 84th annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, May, 1948.

told me I had cataracts in both eyes. I immediately stopped nursing (the last of November, 1946) and had a complete physical examination. A parathyroid deficiency was revealed and I was put on a low-phosphorus diet, calcium chloride, and vitamin D.

"My eye condition seemed to remain stationary until May, 1947, when in two weeks' time the eyes became much worse, particularly the better right one. I became sick at my stomach and saw heavy black spots and wave vibrations before my eyes.

"I now notice that during menstrual periods my vision is much worse, when I also am highly nervous and twitching returns with a tingling sensation in my fingers and feet at night. The muscles of one eye also twitch. My sight definitely is weaker during the week of menstruation."

From this personal account there is very little doubt that this patient had an idiopathic hypoparathyroidism as manifested by the cataracts and tetanic muscular spasms.

As there was no history of any disturbance before her first pregnancy, we must conclude that the idiopathic deficiency which existed at a latent asymptomatic level was increased and aggravated by the pregnancies and periods of lactation and subsequently even by menstruation, to the manifest symptomatic level.

History and Etiology

Relatively few cases of idiopathic hypoparathyroidism or spontaneous parathyroid insufficiency have been described. Two hundred and forty cases of tetany in pregnancy have been reported to 1942, and have been reviewed by Anderson and Musselman.[1] Possibly three additional cases have been reported since then. Of this series, beginning with the report of a case in 1830, 146 were classified as idiopathic, which included those produced by pregnancy and lactation. The report of the presence of cataracts was infrequent. There is no doubt that lenticular changes were present in more cases, and would have been revealed had they been looked for or had better equipment for examination been available. Of still less frequency was the report of the presence of optic neuritis. Postoperative conditions, thyroid deficiency, and dietary lack of calcium and vitamin D comprise the remaining classifications.

The cause of idiopathic hypoparathyroidism is not well understood. It may be the result of an arrest in the growth of the glands, their pathologic destruction, or their degeneration after they have normally developed. They should receive a different and definite classification with the advent of additional knowledge. This loss, from whatever cause, implies, of course, the inability to produce the activating substance, the parathormone, whose chief action appears to be the maintenance of normal blood-serum levels of calcium and phosphorus. Other factors influencing the blood calcium level are the intake of calcium and phosphorus, the presence of vitamin D, the alkalinity or acidity of the ingested food, and the body tissues, and the pH of the blood.

The presence of parathormone increases the calcium level of the blood, as does a slightly acid state. The presence of phosphorus decreases the calcium level in direct ratio. The ingestion of calcium and phosphorus increases the amount of calcium and phosphorus available to the blood and tissues, the excess being excreted. Vitamin D is essential to normal absorption, utilization, and excretion of calcium, helping to maintain a constant normal blood level.

Ninety-nine percent of the calcium in the body is in the skeletal system, which, excepting the mature teeth, is labile and capable of being released back into the circulation. Calcium is found in all of the secretions and excretions of the body, especially in the feces. The regulation and maintenance of a relatively constant level of calcium in the blood depends upon the balance between the calcium intake, utilization, and excretion.

In the latent form of hypoparathyroidism with its accompanying reduced level of

serum calcium, equilibrium is maintained, with a narrow margin of safety, in an asymptomatic course. However, with the advent of pregnancy and lactation, the narrow margin of calcium reserve is reduced by depletion through fetal skeletal and lactogenic needs to the symptomatic level of manifest hypoparathyroidism. Because the previous serum calcium level is never reached after each pregnancy and lactation, subsequent menstruation may sufficiently deplete the reserve to bring about periodically the return of the symptoms.

During early pregnancy, the slight fetal demand for calcium results in no reduction in the maternal blood calcium level, unless there has been an inadequate intake in the diet or unless there is a deficiency in other factors conducive to maintaining a normal level such as is found in parathyroid deficiency. Normally, the necessary increase at this time is adequately provided by the stored calcium. During late pregnancy there occurs a reduction of maternal serum calcium, variously reported as from very little to 0.5 to 1 mg. percent below the previous level. This reduction is produced notwithstanding a hypertrophy of the parathyroid glands in a compensatory effort and the acquisition of a property in the blood of the pregnant woman, similar to that of parathormone, which increases the calcium serum level.

Whether this calcium reduction is still further produced by an altered parathyroid function or is the result of the influence of other endocrine glands which have been activated by the existing condition is at present conjectural. It has also been suggested that the placenta may produce a depressing agent which may influence the calcium level.

Thus, in pregnancy, lactation, and menstruation, it appears that, in addition to the somewhat variable calcium intake, not only the stored but the circulating calcium is called upon to meet the drain for fetal needs and for the production of milk and menstrual loss. When the level of serum calcium is lowered too far, symptoms of neuromuscular irritability and ectodermal trophic disturbance appear.

Symptoms

The chief symptoms of hypoparathyroidism are included under the designation of tetany. The symptoms produced by tetany are common to all types alike. In order of their usual appearance and severity they are:

1. Tingling or paresthesia of the hands, feet, and face.
2. Carpopedal contraction.
3. Contraction of the abdominal muscles.
4. Laryngospasm.
5. Generalized convulsion.

The first three symptoms were found in the patient reported in this paper; the last two in the previously reported case.[11]

Vague or accompanying symptoms are:

1. Fatigue and muscular weakness.
2. Gastrointestinal irritability.
3. General nervous irritability.
4. Mental retardation.
5. Polyneuritis, which includes optic neuritis.

Most of the above symptoms are produced by irritation of the neuro-ectodermal system, chiefly as a result of the nervous excitability produced by a decrease in calcium acting upon the neuromuscular juncture as the contraction is arrested by the administration of curare.

Once more the question arises concerning the type and cause of change in the neural structures accompanying and producing visual loss in tetany. In a previous paper,[11] this condition was reported as possibly a papilledema and cerebral edema, although the marked and early loss of vision was more suggestive of optic neuritis. This condition again introduces itself, appearing during the menstruation in the patient whose case is presented in this paper. She complained of disturbed and diminished vision during her menstrual periods, which was in addition to the gradual loss of sight from her develop-

ing cataracts. Unfortunately, her lenticular opacities prevented a definite view of the papilla.

Papillitis and retrobulbar neuritis associated with pregnancy, lactation, and menstruation have been reported in the literature on rare occasions. The most recent reference found was by Lillie,[10] who described a "marked acute optic neuritis and swelling of the disc 2 to 3 diopters," with complete blindness, in a woman who nursed her third child for 2½ months. So far as can be determined, no laboratory tests were made in any of the reported cases, and no pathologic material was studied. No adequate discussion as to the probable primary cause was presented. It was stated that "the cause of such a neuritis is obscure." Some suggested[8] multiple sclerosis, metabolic, or toxic causes.

If one considers the general subject of polyneuritis, he finds that there is a remarkable similarity between the symptoms produced by this comprehensive nerve involvement and those found in tetany. In both polyneuritis and tetany the sensory, motor, and general symptoms, such as fatigue and mental deterioration, are alike. Restricting the polyneuritis to the cranial nerves, the so-called polyneuritis cranialis, the facial, oculomotor, and vagus are most frequently involved; the optic nerve rarely. These nerves are also involved in the same order in tetany. The literature gives a few sentences to relapsing recurring polyneuritis, and states that this classification includes the cases found in pregnancy and the puerperium. There is the suggestion that the repeated attacks during subsequent pregnancies are due to identical circumstances or minores resistentiae.[15]

Although I do not infer that all polyneuritis has a low blood calcium with tetany, it seems to me very likely that the optic neuritis found in these women during pregnancy, lactation, and menstruation is a type of aspetic polyneuritis which is induced by low calcium level. This polyneuritis, which also affects the central nervous system, may produce an interstitial edema and venous engorgement, with cellular infiltrates and exudates. It also may produce a wallerian degeneration of the axons with demyelinization and neuronal swelling, granulation, fragmentation, and necrosis. It is reasonable to assume that the edema or aseptic inflammation of the visual system occurring in tetany accompanying parathyroid deficiency is the result of the tissue changes produced by calcium deficiency with its concurrent metabolic disturbances and functional loss.

In addition to the neuro-ectodermal affections, changes also occur in the somatic ectodermal tissue, resulting in loss of hair, nails, dental arrest in childhood, and cataract formation.

Hypoparathyroid tetany may be differentiated from other causes by:

1. Reduced serum calcium below 8.5 mg. percent.
2. Normal or increased serum phosphorus above 4.5 mg. percent.
3. Decrease in urinary excretion of calcium and phosphorus.
4. Normal serum phosphatase.
5. Normal acid base equilibrium.
6. Absence of significant osseous changes as evidenced by X-ray findings.
7. Absence of renal insufficiency.*

Treatment

The necessity for various types of treat-

* A low blood calcium with tetany is also found in rickets in the child and osteomalacia in the adult, and in renal insufficiency. Low blood calcium without tetany is found in:

1. Hypoproteinemia whenever there is enough free calcium to produce symptoms of calcium deficiency.
2. Hyperphosphatemia of nephritis and uremia where phosphorus ratio is lower than the calcium level.

Tetany occurring with hypoparathyroidism is found in:

1. Nutritional disturbances with lack of vitamin D and calcium.
2. Depletion from exhausting diseases, poisons, and toxins.
3. Need for greater calcium than can be provided: (a) hyperventilation; (b) alkalosis; (c) Possibly pregnancy and lactation.

ment may be determined by testing the urine or blood. The Sulkowitch urine test for calcium should be made at frequent intervals. If the test reveals a milky precipitate, there is an overabundance of calcium and hypercalcemia is present. If the test reveals clear solution, no calcium is being excreted in the urine and the blood calcium is probably 7 mg. percent or less, the patient being in a state of hypocalcemia. If the test shows a slight clouding, the serum calcium is probably present in normal amounts. If the Sulkowitch test reveals a hypocalcemia, 3 cc. of dihydrotachysterol should be given daily until there is a clouding, and then 1 cc. 3 to 5 times a week as a maintenance dosage. For further check, a blood calcium test should be made at monthly intervals.

The purpose of treatment is to elevate the blood serum calcium content and diminish the phosphorus. Prophylactic medication begun at the fifth month of pregnancy, terminated at labor and resumed at the end of the first month of lactation should be advised. One teaspoonful of calcium gluconate or calcium lactate in water 3 times daily is recommended. Ten cc. of 30-percent solution of calcium chloride 3 times a day after meals will also increase the acidity of the blood, which in turn will raise the calcium level. The calcium and phosphorus intake must be increased 10 to 20 percent in pregnancy, and much more in lactation. This means an average daily intake of 1.5 gm. of calcium in pregnancy and more in lactation. It may also be needed after pregnancy, as it must be remembered that the blood serum thereafter is pegged at a lower level. In addition to the increased calcium, the phosphorus and phosphate intake should be restricted. Dihydrotachysterol and vitamin D should be given.

Dietary restrictions and needs should be considered. Dairy products, meats, legumes, potatoes and whole wheat cereals should be restricted or curtailed. One must remember that although milk contains an abundance of calcium, it also contains an abundance of phosphorus, which unites with the calcium to form an insoluble calcium phosphate which at least partially nullifies the benefit of the

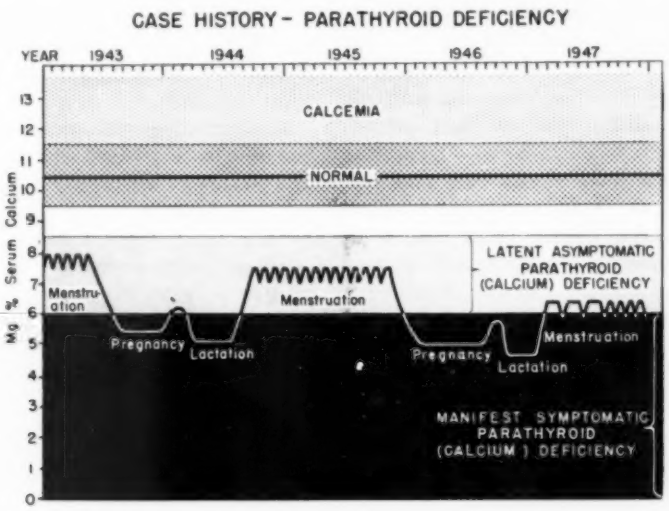

Fig. 1 (Lyle). A schematic arrangement charting the fluctuation of the serum calcium level in a patient with idiopathic parathyroid deficiency during pregnancy, lactation, and menstruation.

calcium. Foods which may be approved are fruits, vegetables, fats, and carbohydrates.

If tetany appears, and with it the probability of cataract and optic-nerve involvement, active treatment is necessary to raise the blood calcium level immediately. In the acute state, inhalation of 5 to 10-percent carbon dioxide in air or oxygen will reduce the alkalinity of the blood and raise the calcium concentration. Ammonium chloride by mouth will have a similar effect. Sedatives to relieve the tetanic spasms of contraction may be necessary. Chloral hydrate, barbitals, or demerol may be of use for this purpose. Magnesium salts in various forms of administration may be employed to reduce the irritability and swelling. Calcium salts employed in a like manner may have an immediate effect of short duration. Ten to 20 cc. of 10-percent calcium gluconate may be administered intravenously and 25 to 30 gm. of calcium lactate may be given in warm water orally.

In the chronic state, the treatment, aside from dietary aids, is the administration of calcium in various forms, parathyroid hormone, vitamin D, and dihydrotachysterol.

Summary

A case history of a patient having idiopathic parathyroid insufficiency was presented to introduce the subject (fig. 1). Her developing symptoms produced by cataract and tetany were described as she passed through pregnancy, lactation, and menstruation. A brief history of spontaneous or idiopathic hypoparathyroidism was presented. Possible causes of its production were mentioned. The sources, use and disposition of calcium to meet the body needs were described, and factors influencing its activity were enumerated. The changes produced by pregnancy, lactation, and menstruation were discussed, and the symptoms resulting from the additional presence of hypoparathyroid insufficiency were described and a differential diagnosis was outlined.

Treatment was recommended for prevention and for the latent and manifest stages of parathyroidism.

Conclusion

The increased demand for calcium during pregnancy, lactation, and menstruation may change an asymptomatic latent parathyroid deficiency into a symptomatic manifest hypoparathyroidism, with serious consequences to vision through ectodermal damage, both neural and somatic. These complications can be averted by routine examination during early pregnancy and lactation. Treatment, once the symptoms have appeared, may arrest but cannot entirely restore the visual loss.

601 Union Trust Building (2).

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ETIOLOGY OF TRACHOMA*

YUKIHIKO MITSUI,† M.D.
Kumamoto, Japan

This article is based on a series of investigations performed under the guidance of Prof. Shinobu Ishihara and Prof. Takeo Tamiya at Tokyo University. A total of 105 human inoculation experiments were performed, in cases hopelessly blind from other causes. The results have been published in a Japanese monograph.[21]

1. Adult inoculation with trachoma.[1-3] Material from cases of the late chronic stage of trachoma but with typical, confluent, turbid follicles was inoculated in 31 cases, with 26 positive results. The inoculum, obtained by scraping the follicles at the superior border of the tarsal conjunctiva with a knife, was rubbed into the conjunctival surface. The only aseptic precautions were an irrigation with sterile boric acid solution and the usual sterile procedures. In positive cases the incubation period was 3 to 9 days with an average of 5 to 6 days. The initial stage was always an acute conjunctivitis and, in all cases, follicles appeared within a few days. After several days, there was a full-blown acute follicular conjunctivitis. Acute inflammation reached its climax within a month, then began to subside, and within 1 to 3 months gradually went over to the chronic form. Prowazek-Halberstaedter inclusion bodies were found without exception.

In the majority of the cases, the signs of chronic follicular conjunctivitis were persistent. Examination even after 1 or 2 years revealed the typical signs. Perfect cure within several months was the exception. In 18 cases the disease went over to the second eye spontaneously. The symptoms and course were almost the same as those in the inoculated eye. Prowazek-Halberstaedter inclusion bodies were also found without exception. Their numbers were in proportion to the severity of the clinical symptoms.

ETIOLOGIC NATURE OF PROWAZEK-HALBERSTAEDTER INCLUSION BODIES

A. DEMONSTRATING THE BODIES IN CHRONIC TRACHOMA

The first object was to establish a positive identification of the inclusion bodies, when present, in chronic cases, because it has been commonly believed that the Prowazek inclusion bodies cannot be readily demonstrated in the chronic stages of trachoma.

The following total of 823 cases were studied in order to clarify this point: (1) A preliminary study of 290 cases in the ophthalmology department of Tokyo University;[4] (2) A farmer's village, Naruse, Kanagawa Prefecture, 175 cases[6]; (3) A fisherman's village, Shinojima Island, Aichi Prefecture, 156 cases[7]; (4) A special series in the ophthalmology department of Tokyo University, 202 successive cases.[8]

Prowazek-Halberstaedter bodies were found in 537 (65 percent) of the 823 cases. These 823 cases consisted of both typical and suspected cases. Among 392 cases with typical clinical symptoms, 336 (85 percent) were positive for the inclusion bodies. The results are summarized in Table 1.

The percentage of positive findings, as well as the number of Prowazek-Halberstaedter bodies counted, paralleled the development of the follicles, that is, it followed the number, turbidity, and confluence of the follicles, and hence was more dependent on the presence of such follicles than it was on the early or late stages of infection.

This is in contrast with the conclusion, from unselected cases, that the finding of inclusion bodies decreases with increasing chronicity (table 1, column 1). If the advanced cases are selected according to typical

* From the Kumamoto Medical College.
† Assistant professor of ophthalmology.

follicle formation, and the increasing proportion of latent or doubtful cases are excluded, then there is only a small decrease of percentage of cases positive for inclusion bodies, as can be seen from the last three columns of Table 1. Instead of 100-percent findings of inclusion bodies, as occurred with 47 acute cases from the same districts, the incidence of inclusion bodies in these chronic cases with typical folliculitis was of the order of 80 to 90 percent.

The question arises why even this small decrease from 100 percent should occur. The answer is simple. In the acute stage, the follicular inflammation is not only typical but also severe. Conversely, in chronic stages the frequency of severe follicular inflammation decreases, as the conversion to milder cases increases, even though the milder cases may be still classified as typical (table 1, column 2). It can be said that there is no real trachoma without Prowazek-Halberstaedter inclusion bodies.

The many reports asserting a marked lessening of positive findings in chronic stages may be the result of technical differences such as different procedures and classifications.

Technique. It was important not to disturb the lesions by irrigation or other treatment. The inclusion bodies were found in the uppermost epithelial layers of those follicles which had become turbid and confluent. Scrapings were collected exclusively from such regions, which occurred chiefly in the conjunctiva of the upper fornix. Translucent, not confluent, follicles yielded few inclusion bodies; papillas and cicatrix almost none.

The conjunctival sac was anesthetized by instillation, without irrigation, of 2-percent cocaine. Turbid, confluent follicles were scraped with a cover glass, taking care not to rupture the follicles or cause hemorrhage. The smear, spread as in the method of blood smears, was then fixed with methyl alcohol and stained. The most suitable staining was obtained with 2 to 3 drops of Giemsa stain (Grübler, prepared in carbon-dioxide free distilled water; other brands were unsuitable) in 2 cc. of distilled water for 30 to 60 minutes at room temperature. More rapid staining, adequate for diagnosis, can be obtained by using 5 to 10 drops of stain in 2 cc. of the carbon-dioxide free distilled water. The inclusion bodies are best located with a magnification of 40 or 80 times, and then studied under oil immersion.

TABLE 1

PERCENTAGE OF TYPICAL CASES OF TRACHOMA WITH PROWAZEK-HALBERSTAEDTER BODIES

Stage of Infection	Prowazek Bodies	Tokyo University, 1938		Prowazek Bodies Special Series		
		Percent Cases:		Naruse Village	Shinojima	Tokyo Univ. 1939
		Typical	Severe			
Acute	100	100	100	100	100	100
Chronic:						
Stage 1	59	73	25	81	76	82
Stage 2	54	60	4.4	87	83	87
Stage 3	37	50	0.8	74	100	96

Chronic Stage 1 is classified as an early stage without cicatrix.
Chronic Stage 2 is an advanced stage with superficial cicatrix but without complications due to cicatricial shrinkage.
Chronic Stage 3 is the late stage with thick, deep cicatrix and complications due to cicatricial shrinkage, such as trichiasis or entropion.
A typical case is a case with follicles which are turbid and confluent.
A severe case is a typical case in which the follicles are rich in number, markedly turbid and markedly confluent. It does not include the chronic cases wherein the appearance of severity is due to secondary changes dependent upon entropion, ectropion, blepharophimosis, or pannus formation.

B. Histologic investigation of inclusion bodies[5]

Tissue sections were positive for Prowazek-Halberstaedter bodies in 92 percent or 108 of 117 cases. The inclusion bodies were in the epithelial cells at the tops of the follicles. Inclusion bodies were never found in the subepithelial tissues; they were in epithelial cells only. It has been a question for some time, how they can occur only in this site if they are the infecting agent, and why they cannot be found in the follicles themselves, which are the site of the most significant changes in trachoma. Theoretically, it may be unnecessary to prove the existence of the virus in the follicle, since a toxic substance, elicited or elaborated by the virus, may cause the follicles.

Investigations were performed to determine whether the locus of the virus is identical with the histologic site of the inclusion bodies.

C. Absence of trachoma virus in subconjunctival tissues[9]

Ten cases of typical trachoma, trachoma with turbid and confluent follicles, in various stages, all Prowazek inclusion-body positive, were selected as donors. Subconjunctival tissue, usually from the tarsal tissue as indicated in Figure 1-a, was taken in order to avoid touching the conjunctival epithelium. The tissues were ground in Tyrode's solution so as to make an emulsion. Ten eyes of 6 patients were inoculated by dropping the emulsion into the conjunctivas and massaging. These recipients were blind from intraocular diseases, such as optic-nerve atrophy and absolute glaucoma, but were free of trachoma. The results were all negative.

Two control inoculations into 2 eyes were both positive; they reacted with a typical trachoma, and were positive for inclusion bodies. The inoculum for these controls was prepared in the same manner as above, except that the starting material was obtained as scrapings from the conjunctival epithelium of the upper tarsus as in Figure 1-b from 2 of the same donors.

A second investigation was designed to determine if subconjunctival inoculation would result in trachoma.[10] The inoculum from conjunctival trachoma epithelium scrapings was prepared as before. It was injected, from the cutaneous side as in Figure 2-a, subconjunctivally into the region of the retrotarsal fold. Ten such inoculations were performed. They all remained negative for trachoma. A control instillation of the same inoculum into a conjunctival sac was positive, as in Figure 2-b. Absence of pathogenic bacterial contamination was demonstrated by culture and subsequent control inoculation of these cultures into human eyes.

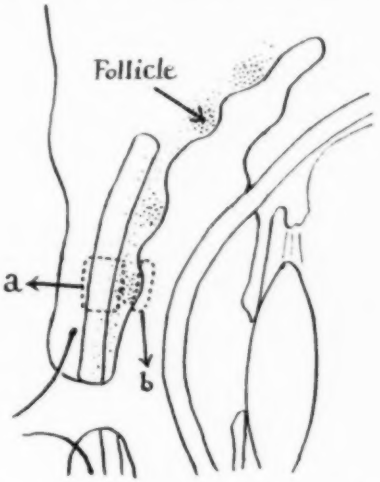

Fig. 1 (Mitsui). (a) Tarsal plate tissue of a typical trachomatous case was removed surgically from the cutaneous side, and inoculated with negative result. (b) Scrapings from the tarsal conjunctiva of the same case were inoculated with positive result.

From these results, it is concluded that (1) The trachoma virus exists only in the epithelial layer, not in the subconjunctival tissues; (2) the trachoma virus cannot cause trachoma when it is introduced into the subconjunctival tissues only, without touching the epithelium. It may be said that the tra-

choma virus and the Prowazek-Halberstaedter inclusion bodies are at the same locus, regardless of whether or not the inclusion bodies are the actual infectious agent.

D. Provocative tests[11]

In the above investigations, it was easier to demonstrate the inclusion bodies in the cases with the more severe folliculitis. Similarly the case of demonstrating inclusion bodies lessens with the decrease of number, turbidity, and confluence of the follicles, during and after treatment.

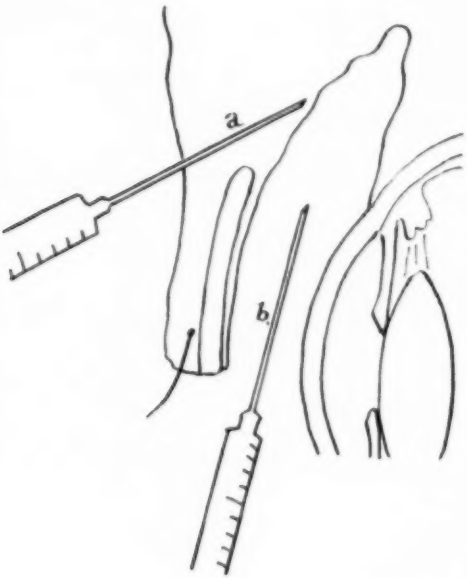

Fig. 2. (Mitsui) (a) Suspension of scrapings from typical trachoma cases was injected subconjunctivally from the cutaneous side. It could not start trachoma. (b) The same inoculum was dropped into the conjunctival sac. The trachoma started.

To investigate the converse, whether the case of demonstrating inclusion bodies increases, in the individual case, with exacerbation of the typical folliculitis, a method for provocation of the disease was utilized. The conjunctivas were scraped with the edge of a knife or rubbed with cotton. Then, without irrigation, a bandage was placed over the eye. In 8 of 15 cases, the severity of the folliculitis was reached within 5 to 10 days and, at the same time, the number of inclusion bodies increased.

The inclusion bodies, on the whole, were smaller in the acute stages of the exacerbations, which also occurs in the acute stages of the spontaneous infection. But, when the typical follicular lesion in the provocative test increased gradually, the frequency of the larger cells, containing elementary bodies, increased also, just as in slowly progressing spontaneous trachoma.

E. Pure culture of Prowazek-Halberstaedter bodies

The conjunctival sac was first thoroughly irrigated with sterile saline solution. A strip of conjunctival tissue with marked follicle formation was removed surgically and cut into 1 by 1 mm.-sized pieces in Tyrode's solution.

The sterile culture medium was made up of two stock portions: (a) Human blood plasma, 1 part, chicken blood plasma, 2 parts; and Tyrode's solution 10 to 30 parts. (b) Juice of chicken embryo. At the time of culturing, the stocks a and b were mixed in the ratio of 2:3 or of 3:5.

The epithelium grew by cell division. Inclusion bodies were found also in what appeared to be new cells.

In second generation subculturing, the above tissue cultures were ground to a suspension and diluted 10 times in Tyrode's solution. Tissue from normal conjunctivas was carried through this suspension and then cultured as above.

Smears of the cultures, at 2 to 5 days, were stained and examined. By comparison with the original tissue, the number of cells with inclusion bodies increased, as did also their size, with elementary bodies filling almost the entire cytoplasm. Of 2 cases with too few inclusion bodies to demonstrate initially, inclusion bodies could be demonstrated from the culture in 1 case. Cultivated

tissue introduced into the human eye in 4 cases, resulted in trachoma each time. Such inoculations from subcultures, however, were not successful. Hence, although these cultures suggest that the infectious agent has been cultured, they do not prove this conclusively.

Relationship between trachoma and inclusion blennorrhea

Inclusion blennorrhea of the newborn was studied in 18 cases.[14, 15] This provided a basis for comparison.

Inoculations of suspensions from tracho-

The converse inoculation, from the conjunctivas of newborn children with inclusion blennorrhea into adult conjunctivas, was performed in 10 eyes[16] of 10 adults. The resulting disease in the adult was identical with inoculated trachoma of the adult,[1-3] but not with inclusion blennorrhea of the newborn.

To exclude possible individual variation, the 2 inoculations (trachoma inoculum and blennorrhea inoculum) into the 2 eyes of the same individual were performed in 7 cases. No essential difference between the two eyes was observed;[17] all exhibited the trachoma-

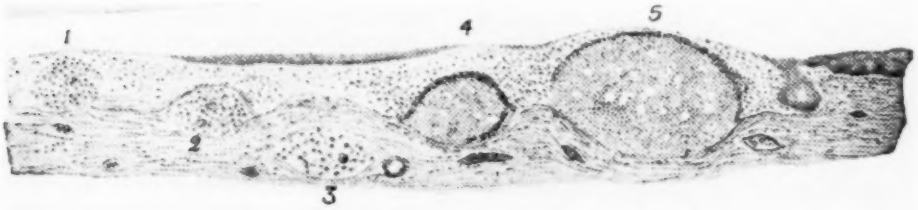

Fig. 3 (Mitsui). Trachoma follicles of the inclusion blennorrhea type.

matous scrapings were instilled into the conjunctival sacs of four eyes of four newborn children, blind from congenital anomalies such as microphthalmos and corneal degeneration but not having trachoma, at 5 to 20 days after birth. The response, a blennorrhea or pseudomembranous conjunctivitis, was followed clinically.

Follicles were not found until the babies became several months old, but these follicles were somewhat different from those of adults, just as those of spontaneous inclusion blennorrhea are different. They formed deep in the areolar connective tissue layer, as indicated in Figure 3, instead of the adenoid tissue, as in the adult trachoma (fig. 4). They had a "naked" appearance, that is, with little or no wall of lymphocytes (fig. 4).

Trachoma in the newborn is, therefore, quite different than that of the adult, but identical with the inclusion blennorrhea of the newborn, both clinically and microscopically.

tous type of infection.

Tissue sections of the cervical canals, but not of the vaginas, of mothers of babies with inclusion blennorrhea, had microscopic changes similar to those of conjunctival trachoma.[18] Prowazek-Halberstaedter inclusion bodies in the cervical scrapings were found in one case. Instillation of inoculums prepared from cervical canal scrapings, pre-

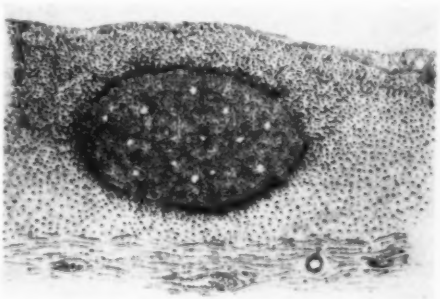

Fig. 4 (Mitsui). Trachoma follicles of the adenoid or adult type.

pared from 6 cases, into 6 adult eyes of 6 people resulted in typical trachoma.

The converse experiment,[10] inoculation of the female genital tract with trachomatous materials, produced the typical infection of the cervical canal as manifested by microscopic changes. In the cases of the 2 women so inoculated, continued presence of the infectious agent was demonstrated 14 days later, by a further inoculation into other adult eyes. Gynecologic examination 7 months after inoculation in 1 of the women demonstrated that there were clinical and microscopic findings of genital trachoma, including follicle formation, cellular infiltration, and numerous inclusion bodies, in tissue sections of cervical-canal epithelium.

No doubt can remain that trachoma and inclusion blennorrhea are results of the same infection. Inclusion blennorrhea is infant trachoma. Furthermore, trachoma is not exclusively an eye disease, but can alternate between the eye and the female genital tract. It may be assumed that the disease of the female genital tract is the usual source of infection during delivery, resulting in inclusion blennorrhea of the newborn.

Trachoma in the lacrimal apparatus[12]

It is well known that trachoma follicles are most readily found in the tarsal conjunctiva, or in the conjunctiva of the retrotarsal fold. These are loci of cylindrical epithelium, the epithelium of the fold being the more typically cylindrical. The cuboidally flattened epithelium of the bulbar conjunctiva or the squamous epithelium of the cornea are hardly affected by trachoma, except secondarily. Likewise, the genital tract trachoma showed that the cylindrical epithelium of the cervical canal could be easily infected, but the stratified squamous epithelium of the vagina could not.

The cylindrical epithelium of the lacrimal sac was also found to be affected by trachoma.

A suspension of trachoma material was injected with a lacrimal syringe into 6 lacrimal sacs through the inferior punctum. The sacs were removed 10 to 51 days after inoculation and were examined histologically. The changes were identical to those of trachoma of the conjunctiva. Inclusion bodies were demonstrated in 5 cases.

The lacrimal sacs were removed from 6 cases of early conjunctival trachoma; 1 of these had been experimentally inoculated, 1 was in the acute stage, and 4 were in an early chronic stage of infection. Histologic changes in the sacs were almost identical to those of the conjunctiva. Inclusion bodies were found in 5 of them. In 2 cases, the canaliculi were examined. Inflammatory changes consisting of round-cell infiltrations and follicle formations were slight, as compared with those of the sacs, yet inclusion bodies were present in the epithelium of each.

The lacrimal sac was examined in 1 case of conjunctival trachoma induced by inoculation from a case of inclusion blennorrhea. Changes were like those of spontaneous trachoma and many inclusion bodies were present.

Lacrimal sacs were also studied in 13 cases of chronic conjunctival trachoma. Follicle formation and cellular infiltration were slight as compared with the conjunctivas of the same cases; cicatricial changes were marked. In some cases, the resulting constriction had reduced the lumen of the sac greatly. Inclusion bodies were found in one case.

In nonspecific, chronic dacryocystitis, unaccompanied by trachoma, the inflammation was not specific and no inclusion bodies were found.

Clinical course of trachoma

A. Initial acute stage

Formerly, it was believed that trachoma starts insidiously, and so-called acute trachoma was thought to be only an exception. It was known that an inoculated trachoma started acutely, but this was considered to

be a special response to inoculation, such as might result from an infection with enormous numbers of virus at one time. For reasons to be summarized, it is concluded that without exception trachoma starts acutely and that the incubation period is 3 to 9 days, usually 5 to 6 days.

Inoculation trachoma, in 68 cases,[1, 9, 10, 13, 15-19] started acutely without exception. The incubation period was slightly shorter with larger doses of inoculum, and the folliculitis somewhat less acute.[17] Not only was the onset of the inoculated trachoma acute, but so also was that which went over spontaneously to the second eye, 21 cases.[1, 15, 16, 18] In none of these cases, whether by inoculatio nor by spontaneous spread to the second eye, did the trachoma start insidiously.

Acute trachoma is not a rare occurrence. In 6 months, 44 cases were seen in Tokyo University.[8] Meanwhile, 202 cases of chronic stages were observed. Of the 44 acute cases, the great majority had received prior treatment from their local ophthalmologists for what was evidently considered to be a simple follicular conjunctivitis rather than an acute trachoma.

Thirty-three patients,[8] with trachoma in the early chronic stage, gave a history of an acute conjunctivitis originating 1 or 2 years previously, starting in one eye and being followed 7 to 14 days later by a similar onset in the second eye. This long delay is consistent with the incubation period of trachoma, as contrasted with the rapid onset of a bacterial conjunctivitis, signs of which were lacking. The subjective symptoms had subsided slowly. Their local ophthalmologists had told them that they had an acute conjunctivitis; those who had been told that they had an acute trachoma were the exception.

Another reason for the persistent belief that an acute trachoma is the exceptional form of trachoma arises from the apparently benign nature of the disease. The cicatrix and pannus do not occur until several years later.

Still another reason that trachoma has been easily overlooked in its acute stage, is evident from the statistical investigations in Naruse[6] and Shinojima,[7] where the initial affection of trachoma occurs in childhood, usually before 3 or 4 years of age. It is evident that, through the lack of an active complaint from the patients, any acute conjunctivitis in childhood may be considered and treated lightly. Hence the tendency to overlook trachoma of the acute stage. In regions of high trachomatous incidence, it may be presumed that acute trachoma should be a childhood disease.

This is supported by the relation of the percentage incidence of all stages of trachoma with respect to age, in the villages of Naruse and Shinojima. The incidence approached was 17 percent and 75 percent respectively. These levels were already approached at the school age and remained practically constant thereafter, although the trachoma progressed to more advanced stages of the disease in the advanced age groups.

B. Interval for chronic trachoma

Analysis of cases of trachoma in Naruse and Shinojima indicated the following: Chronic trachoma occurring in young people is of the first-stage type, without cicatrix, in the majority of cases; in middle aged people, it is usually of the second-stage type, superficial cicatrix without complications; and the third stage, cicatricial retraction and complications, is almost exclusively observed among people over 40 or 50 years of age. This indicates that trachoma may persist for a long time, perhaps 10 or 20 years or more, after the acute stage and before formation of cicatrix; perhaps 40 to 50 years before cicatricial retraction and complications.

C. Healing of acute trachoma

It is known that numerous cases of early trachoma can be cured without leaving any trace. The earlier the improvement the more likely the cure. It is, therefore, a most important problem from the standpoint of pub-

lic health that trachoma be detected in the early stage. For this, examination for inclusion bodies is indispensable.

The procedure utilized and discussed herein for recognition of suspected, suspicious, typical, and atypical cases should become familiar to all ophthalmologists in routine examination of ocular infections.

Kumamoto Medical College.

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THE DUPUY-DUTEMPS DACRYOCYSTORHINOSTOMY*

ALTON V. HALLUM, M.D.
Atlanta, Georgia

Dacryocystorhinostomy has proved to be so highly successful in the hands of many surgeons that extirpation of an obstructed lacrimal sac has come to be supplanted by it, just as couching long ago was supplanted by cataract extraction. Another surgical analogy of extirpation versus dacryocystorhinostomy might be made of the orthopedic surgeon who would elect to amputate a patient's broken leg, rather than go to the trouble and time to help restore the function of the leg. The extirpation of obstructed lacrimal sacs is usually successful in relieving the pus and mucus, but the majority of the patients are doomed to a life of lacrimation and its annoying impairment of vision. A correctly performed dacryocystorhinostomy in selected cases can be expected to relieve completely pus, mucus, and tearing in at least 95 percent of the cases.

HISTORICAL REVIEW

The reader is referred to Chandler's[1] discussion on this subject in which he reports an exhaustive survey of the literature. According to Chandler, history shows that operations were performed by Celsus, to make a new passageway from the tear sac into the nose as long ago as the first century and by Galen in the second century. In modern times, in the early 18th century, Woolhouse and Platner performed operations to reëstablish drainage of the lacrimal sac into the nose. The procedure was apparently forgotten or abandoned for approximately two centuries.

In 1904, Speciale-Cirincione[2] and Toti,[3] in Italy, revived the operation, each with a different technique. Speciale-Cirincione's transplantation operation consisted of lifting the sac from its bed and pushing the lower end of the sac into the nose through a new bony opening. The transplantation operation is applicable only to those cases where the obstruction is limited to the lower end of the lacrimal sac and nasolacrimal duct.

Forsmark,[4] Stokes,[5] Gifford,[6] and others have reported highly successful series of operations using the transplantation method. Toti advocated removing the nasal wall of the lacrimal sac and a corresponding area of the underlying lacrimal and maxillary bone and muscosa, thereby reëstablishing drainage from the lacrimal sac into the nasal cavity.

Many variations in the technique of Toti have been made by different surgeons. In 1912, Blascovicz[7] made the first significant change by cutting away all of the sac wall except a small portion immediately surrounding the opening of the canaliculi. In 1914, Kuhnt[8] was probably the first to approximate the mucous membranes by sutures. Ohm,[9] in 1920, advised making vertical incisions in the nasal mucosa and lacrimal sac wall and then suturing the respective posterior flaps and anterior flaps.

In 1921 Mosher[10] described a modification of Toti's technique. He advocated (1) exenterating the ethmoid cells in the vicinity of the lacrimal sac, (2) resecting the nasal mucosa from the bony window, (3) resecting the inner wall of the sac and duct down to the upper rim of the inferior turbinate, and (4) removing the anterior tip of the middle turbinate.

In an address in 1937, as guest of honor of the American Academy of Ophthalmology and Otolaryngology, Mosher[11] stated the operation should be successful in 90 percent of the cases if properly performed. He also said that in his opinion a high deviation of

* From the Department of Ophthalmology, Emory University School of Medicine. Presented at the 84th annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, May, 1948.

the nasal septum should be previously straightened, to prevent blocking of the new opening. The technique as outlined by Mosher requires that the surgeon be an experienced rhinologist.

Also in 1920-1922, Dupuy-Dutemps and Bourguet[12] described a modification of Toti's technique, similar to Ohm's, which was much simpler than Mosher's, and required no intranasal surgery. They reported more than 1,000 operations in which 94 percent had been successful. During recent years, Chandler,[1] Rychener,[13] Yanes,[14] Hughes, Guy, and Bogart,[15] Hallum,[16] and others have reported series of operations using the technique popularly known as that of Dupuy-Dutemps. Each of the surgeons has reported successful results in nearly all of the cases, Chandler and Rychener in 100 percent of the cases. Chandler prefers to make T incisions instead of I incisions in the sac wall and nasal mucosa.

Traquair[17] reported 409 operations by the technique of Toti and a follow-up on 321 of the patients found that 80 percent of them had been relieved of watering. He altered the technique of Toti by suturing a flap of nasal mucosa to the anterior margin of the lateral sac wall after he had removed the inner wall of the sac. Thus his technique was very similar to that of Ohm and Dupuy-Dutemps.

Hogan[18] recently reported a series of 49 Toti-Mosher operations done at the University of California over a 20-year period, including the cases formerly reported by Martin and Cordes[19] and Martin.[20] These surgeons feel that the operation as done by them should be successful in 85 to 90 percent of the cases.

The postoperative care necessary to prevent granulation tissue from blocking the new passageway is a great task for the surgeon, and is one of the greatest shortcomings of this procedure. They perform postoperative irrigation of the lower punctum daily for the first week, then twice weekly for a month, and thereafter at monthly intervals.

Etiology of obstruction of the nasolacrimal passageway

When this subject is discussed by rhinologists[21] some of them say that as high as 95 percent is of nasal origin. But when discussed from the standpoint of the ophthalmologist, it appears that the nose plays a relatively insignificant role in producing infection in the lacrimal sac. In Traquair's 409 cases he found only one with any obvious intranasal pathology. This patient had a few small polypi in the middle meatus, which were removed during the operation.

Most patients are unable to associate the onset of the epiphora and pus with any acute nose or lid infection. Trauma was the predisposing factor in 4 or 5 percent of most series, but in my series it was the cause in 17 percent. The most constant factor in most series is that the great majority of patients are women. The percentage of women was 80 in Traquair's series, 66 in Gifford's series, and 58 in my series. As Traquair points out, sex predilection alone rules out the possibility that the disease originates in the nose, since there is no nasal disease which is five times more common in females. According to Garfin,[21] Meller and Schaeffer believe that the anatomic difference of the nasal bones causes the lumen of the lacrimal canal to be narrower in women than in men. Traquair has noticed an hereditary factor in 11 percent of the latter part of his series.

It is of unusual interest here that congenital occlusion of the lacrimal ducts occurs about equally in the two sexes. It is also well known that congenital occlusion of the lower end of the canal is cured in the great majority of cases during the first year of life by massage only, and if this conservative treatment fails, one probing at the age of 6 to 12 months almost always gives complete relief without a tendency to become occluded again.

Bacteriologic picture

Traquair did a bacteriologic examination of the conjunctival sac in 251 cases of oc-

clusion of the lacrimal sac of duct in which Toti's operation was subsequently performed, and repeated the examination in 95 of the cases after the operation. He did not state how long after the operation the second examination was made, nor whether he made more than one postoperative examination. Two hundred and twenty-five eyes examined before cataract extraction were used as controls. No growth was found in 12 percent of the cases of lacrimal obstruction, nor in 16 percent of the controls. Pneumococci or streptococci were found in 32 percent of the cases of lacrimal obstruction, and in 6 percent of the controls. Staphylococci were found in approximately the same percentage of cases in each group. The effect of dacryocystorhinostomy was to reduce the streptococci from 32 to 11 percent; whereas, the control group showed 6 percent. Several cases of cataract extraction were performed by Traquair after the Toti operation, and Arruga[22] reported more than 30 cataract extractions after the Dupuy-Dutemps dacryocystorhinostomy, without any infectious complication. According to Garfin,[21] Rollet and Bussey's series of obstruction of the lacrimal sac showed pneumococci in 60 percent, streptococci in 10 percent and no bacteria in 26 percent. They found mucoceles to be almost sterile.

Indications for dacryocystorhinostomy

The operation is indicated in stricture of the nasolacrimal duct or any portion of the lacrimal sac, or in cases of absence of the lacrimal sac, provided the lower punctum and lower canaliculus are normal.

Dilation of the lacrimal obstruction should be attempted in every patient, regardless of how long-standing the condition. One patient suffering from an acquired unilateral obstruction of 20 years' duration was completely relieved of tearing and mucopurulent discharge by a single probing. The passage of a probe should be attempted in order to learn the level of the stricture. However, if passing a No. 2 or 3 Bowman probe all the way into the nose does not relieve the obstruction after 2 or 3 weekly probings, it is useless to continue. In fact, repeated probings that progressively dilate the lower punctum are contraindicated, since they will cause tearing after a subsequent dacryocystorhinostomy. The lower canaliculus should never be slit, for the same reason. If an external fistula is present, it is disregarded in performing the operation, and it will close spontaneously, within a few days after reëstablishing lacrimal drainage into the nose.

Contraindications for dacryocystorhinostomy

If either the lower punctum or lower canaliculus is not normal, watering will continue after the operation but the patient will be relieved of mucopurulent discharge. A normal upper punctum and upper canaliculus will usually not keep an eye free of tearing if the lower punctum and lower canaliculus are not functioning. The operation should not be done in tuberculous or malignant involvement of the sac, and should be postponed for at least a month after any acute inflammation of the sac or nose has subsided. Any obstruction in the nose should be remedied, and the patient allowed to recover from the procedure, before dacryocystorhinostomy. There is almost no age limit for the operation, if the patient is otherwise in good health. The youngest of my series was aged 4 years and the oldest, 73, and other surgeons have reported successfully performing the operation on even younger and older patients. The younger the patient the softer is the bone, and it is proportionately easier to make the bone window. The dimensions of the anatomic parts involved in the young are surprisingly close to the dimensions found in the adult.

Stallard[23] in 1940 reported on original operation that was successful in relieving epiphora in a patient who had both canaliculi cut in an accident. The upper end of the

sac was dissected from its bed, and transplanted through a stab wound into the lower cul-de-sac. After the upper end of the sac was sutured to the conjunctiva, anteriorly and posteriorly in the depth of the lower cul-de-sac, the dome of the sac was excised. This procedure might be found more effective than trying to reconstruct canaliculi and puncta.

Technique of the operation

Anesthesia

The usual preoperative sedatives should be given. The operation can be done under local or general anesthesia, depending entirely on the excitability of the patient. If general anesthesia is thought advisable, sodium pentothal intravenously has been found to be the most satisfactory, since it reduces to a minimum the necessity of the anesthetist working near the operative field. If ether anesthesia is preferred, after induction with gas or the ether cone, it should be vaporized by the ether machine through the side-lip mouth airway into the nasopharynx, thus eliminating the necessity of the ether cone.

If local anesthesia is desired, a long pledget of cotton saturated with one-percent pontocaine or nupercaine, or 4- to 10-percent cocaine, is placed high in the nasal fossa on the side to be operated. The face and operative area is cleansed in the manner that is usual for any ocular operation. It is best not to instill topical anesthesia into the eye, since the patient's normal blink reflex is desired to make him protect his cornea by keeping his lids shut.

Two-percent procaine hydrochloride, containing five drops of 1:1,000 epinephrine hydrochloride to the ounce, is injected into three areas, using a long, fine (27 gauge) needle. A small amount, about 0.5 cm., is injected along the site of the incision just beneath the skin; 2 cc. is injected just below the supraorbital notch, extending downward along the periosteum, infiltrating the region of the dome of the sac. This anesthetizes the supraorbital nerves supplying the upper end of the sac. Another 2 cc. is injected in and over the infraorbital foramen, the last portion of which is directed upward and inward to infiltrate the region of the lower end of the sac. This anesthetizes the infraorbital nerve supplying the lower end of the sac. The surgeon stands at the side of the patient and the assistant stands at the top of the patient's head.

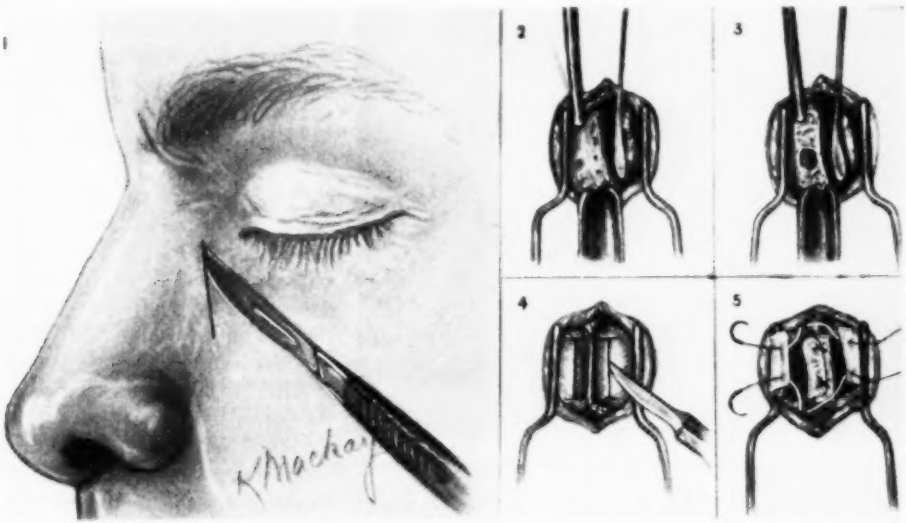
The skin incision

The incision is made straight, as suggested by Mosher and reëmphasized by Hogan, because scar-tissue contraction accentuates the scar if the incision is curved. The incision is begun about 8 mm. nasally and level with, or 1 mm. below, the inner canthus (fig.1). If slight traction with the thumb is made on the soft tissue on the bridge of the nose to the side opposite the operation as the incision is being made, the angular vein and artery will not be cut as often. The initial incision is extended down through the periosteum in its entire length of about 2 cm. The incision extends downward and slightly outward, and should be made with one continuous stroke in order to obtain a straight skin incision. If a large vessel is cut, time will be saved if it is tied with catgut.

The Stevenson lacrimal sac retractor is inserted into the incision and spread tightly. This exposes the depth of the incision, and the pressure helps to control the bleeding. The internal palpebral ligament is not cut, unless the preoperative probing has shown the stricture to be high in the sac, that is, on the level with or just below the inner end of the lower canaliculus. The assistant's main duty is to keep the operative field free of blood by using the suction tip constantly. It is unnecessary to stop the oozing type of bleeding until the bony window has been completed. The best source of illumination is the large overhead portable spotlight with the light passing just above the surgeon's head.

A periosteal, or nasal mucous membrane, elevator is used to push the periosteum nasally and laterally. The first and only

real landmark is the anterior lacrimal crest which is uncovered as the periosteum is pushed laterally. The entire length of the crest is uncovered from the internal palpebral ligament above, downward to and including the lower extremity, where the crest turns laterally to form the anterior rim of the upper end of the nasolacrimal canal. The sac is easily separated from the floor of the fossa and pushed laterally to expose the posterior lacrimal crest.



Figs. 1 to 5 (Hallum). (Fig. 1) The incision. (Fig. 2) Beginning the bony window, with the gouge astride the lower end of the anterior lacrimal crest. The assistant stands at the top of the patient's head, keeps the sac pushed laterally and uses the suction tip constantly. (Fig. 3) Several long, thin slices of bone have been removed and a small area of nasal mucous membrane has been exposed. (Fig. 4) Anterior and posterior flaps are made by making capital I incisions in the medial wall of the lacrimal sac and in the nasal membrane. (Fig. 5) The posterior flaps have been united. The sutures have been placed in the anterior flaps, and each suture includes some tissue on the anterior rim of the bony window, so that when the sutures are tied the flaps will be united and lifted out of the new passageway.

Perforation of the bone

For this procedure a mallet and bone gouge about 1 cm. wide (No. 8 or 10) is preferred. The gouge is set astride the lower end of the lacrimal crest where it turns laterally to form the anterior rim of the nasolacrimal canal (fig. 2). The assistant keeps the sac pushed laterally, using a nasal mucous membrane elevator as a retractor.

The gouge is gently driven with the mallet so that a thin slice of bone is removed along the entire length of the anterior lacrimal crest up to the internal palpebral ligament. If the head block that is used in mastoid surgery has been previously placed under the patient's head, there will be less jarring produced by the mallet. Successive slices of bone are removed in the same manner until in the bottom of the grove a small area of nasal mucosa is uncovered (fig. 3). This small bony opening is enlarged with a small bone curette, until the opening in the bone is large enough to admit the Kerrison forceps. Care must be taken not to perforate the nasal mucosa.

The opening in the bone is enlarged with the Kerrison forceps and sharp-pointed ronguer forceps. The window should be made low enough so that it extends down to the level of the upper end of the nasolacrimal

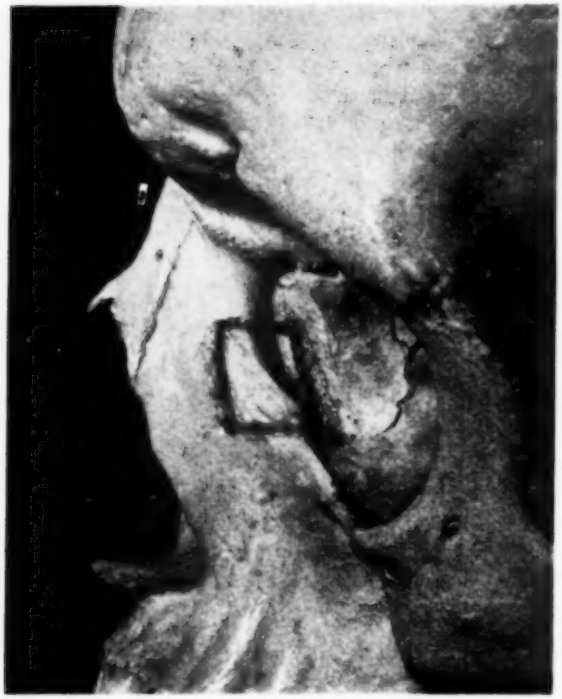


Fig. 6 (Hallum). The correct location of the bony window is outlined on the skull, astride the anterior lacrimal crest. The lower margin of the opening extends down to the upper end of the nasolacrimal canal.

canal (fig. 4). The bone forming the floor of the lacrimal fossa and enough of the bone medial to the anterior lacrimal crest is removed to make the horizontal diameter of the opening at least 10 mm. The opening is extended upward so that the vertical diameter is at least 12 mm. The opening in the bone must be made as low and as far forward as possible in order to avoid the ethmoid cells, and to place the opening anterior to the tip of the middle turbinate (fig. 5).

The mucosal incision

The nasal wall of the lacrimal sac is incised vertically from a point opposite the upper margin of the bony window to a point opposite the lower margin of the bony window (fig. 6). A No. 15 Bard-Parker knife blade serves best for this incision, but Stevens' scissors are often useful in completing the upper and lower ends of the incision. A probe should be passed through the lower canaliculus into the sac and out through the incision in the sac wall to insure the fact that all layers of the sac wall are incised and that there are no other obstructions. The upper and lower ends of the incision are extended anteriorly and posteriorly from 1 to 3 mm., changing the vertical incision to the shape of a capital I, and forming a posterior and anterior flap.

Before making a similar incision in the nasal mucosa, all bleeding should be stopped. The retractor should be removed, the wound packed with cotton saturated with adrenalin, and pressure applied for 2 or 3 minutes.

After replacing the retractor, the site of the vertical incision in the nasal mucosa is then determined by grasping the posterior flap of the sac with forceps and drawing it medially toward the nasal mucosa. At the place where the flap touches the nasal mucosa, an incision is made parallel to the incision in the sac, extending to the upper and lower rims of the bony opening. The upper and lower ends of the incision are extended anteriorly and posteriorly, as was done to the incision in the sac, forming anterior and posterior flaps of nasal mucosa. It is unnecessary to make posterior flaps when the sac lies in contact with the nasal mucosa after the bone has been removed; indeed, in such cases it is occasionally unnecessary to make anterior flaps.

If the anterior end of the middle turbinate should be found to be more or less completely blocking the opening in the nasal mucosa, the visible portion of the turbinate should be excised through the incision with scissors or biting forceps. The small amount of bleeding that might follow can be controlled easily

by pressure applied to gauze inserted through the nares. The presence of polypi found in the same site should be treated in the same manner.

Suture of the mucous membranes

The depth of the operative wound at this stage is usually as great as the length of the vertical skin incision and it is necessary to use extremely short needles in placing the sutures to unite the respective flaps, especially the posterior flaps. Probably the best needle available for this purpose is supplied by Davis & Geck, Inc., New York, and can be ordered by asking for Product C 269. Each of the ampules contains a 3-0 chromic catgut suture armed at each end with a one-half circle one-fourth inch atraumatic needle; each such double-armed suture is enough for one dacryocystorhinostomy.

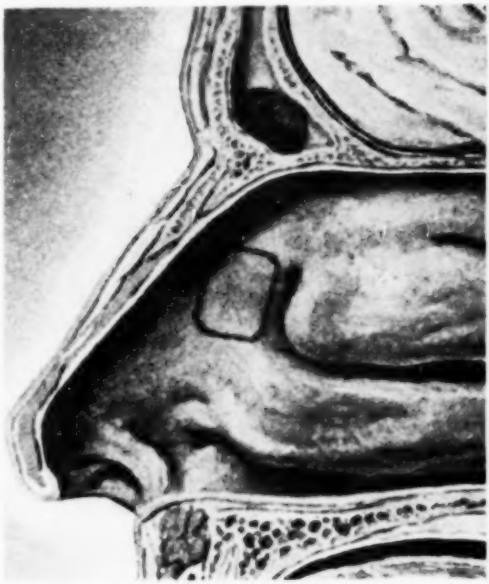


Fig. 7 (Hallum). The bony window, when correctly placed, opens into the nose just anterior to the tip of the middle turbinate.

The posterior flaps are first united by placing a suture at the upper and lower ends of the flaps; occasionally, only one suture is necessary (fig. 7). The anterior flaps are united in a similar manner by placing a suture at the upper and lower ends, except that each suture includes an additional bite of tissue close to the periosteum on the rim of the bony window superiorly and inferiorly, respectively. When these sutures are tied, after loosening or removing the retractor, they not only approximate the margins of the anterior flaps but lift them forward out of the bony window. Thus a new, open, epithelial-lined passageway extends from the lacrimal sac into the nose. The new passageway stays open because the epithelial lining prevents the formation of granulation tissue and adhesions.

Closure of the skin and dressing

Two or three subcutaneous sutures should be taken with the plain catgut, so that the skin can be approximated without traction on the skin sutures. The skin incision can be closed equally well with interrupted or running silk, or with a subcuticular suture. Occasionally no skin suture is necessary. Five-percent sulfathiazole ophthalmic ointment is instilled inside the lids and along the skin incision. A thin layer of petrolatum is spread on the undersurface of the gauze eye patch which is applied over the closed lids. Additional gauze fluffs are added and moderate pressure is applied by placing several strips of one-inch wide adhesive diagonally from the forehead to the cheek.

Postoperative care

At the completion of the operation the patient should lie face down for a few hours so that any bleeding into the nose will not be swallowed. It has not been necessary in a single instance to pack the nose to control postoperative hemorrhage. Usually only a few drops of blood trickle out the nose during the immediate postoperative period.

Bathroom privileges and regular diet are allowed 12 hours later, and the patient may leave the hospital at the end of 48 hours, after the dressing and skin sutures have been removed and a regular gauze eye patch applied.

Fig. 8 (Hallum). (Arruga[22]). Canaliculirhinostomy. A vertical incision is made over the prominence of the end of the probe as it is held in the lower canaliculus. The margins of this incision serve as anterior and posterior flaps.

Physiologic solution of sodium chloride may or may not be irrigated through the lower canaliculus into the nose, using a syringe and needle, but apparently this is unnecessary. However, it makes both the patient and the surgeon happier to know that the new passageway into the nose is open. If fluid fails to pass from the lower canaliculus into the nose, the nose on the side of operation should be examined for obstruction produced by edema in the region of the bony window.

Edema of the nasal mucosa usually can be relieved easily by instilling some vasoconstrictor, either by drops or on a cotton pledget. Then if the fluid fails to pass from the lower canaliculus into the nose, a probe must be passed into the nose through the lower canaliculus and bony window, to break adhesions by gentle movements of the probe.

The patient is dismissed at this dressing if the skin incision is united and free from infection, and he is asked to remove the eye patch 48 hours later. He is warned against opening the incision by pulling on the skin in the region of the operation for a few days.

Recurrence

The patient is advised to return at the end of a week if epiphora persists, or at any subsequent time if epiphora returns, at which time the nasal mucosa must be shrunk with a vasoconstrictor and a probe passed to break adhesions. No cases of late obstruction of the new opening have been encountered, that is, several weeks or months later, but if such a complication should occur the procedure as described by Arruga[22] should be tried. He dilates the lower canaliculus until it admits a Weber knife, with which the membrane covering the bony window is incised across its complete diameter.

Operation in cases of absence of the lacrimal sac

When the lacrimal sac has been previously removed, or is completely occluded, reestablishment of lacrimal drainage into the nose can be obtained by slight variations of the above technique, if the lower punctum is normal and if the lower canaliculus is in good condition along its entire length. Arruga[22] first described this latter procedure and thinks that such an operation should be successful in two thirds to three fourths of the cases. Gifford reports two successful results in three cases, and Hogan one cure in three cases. Two of my series have been successful.

After the customary incision and exposure, the opening in the bone is made slightly larger so that longer flaps of nasal mucosa can be obtained. The medial end of the inferior canaliculus is identified by introducing a probe and maintaining pressure. A vertical incision is made in the tissue covering the prominence of the end of the probe, until the probe passes freely through the incision (fig. 8). The incision is deepened and lengthened until the anterior and posterior lips of the wound actually serve as fair anterior and posterior flaps. The remainder of the operation is the same as in the classic dacryocystorhinostomy.

In my two cases the only variation from Arruga's technique was threading a small silk suture through the lower canaliculus into the nose between the posterior and anterior flaps. This suture was placed after uniting the posterior flaps, but before uniting the anterior flaps. The end of the suture was brought out the nares and tied on the cheek to the other end of the suture. This suture was left in place for three weeks and the patient moved the entire circumference of the suture once daily by pulling the suture out of the nose for one-half inch or so. It was thought that this in-dwelling suture would prevent adhesions and encourage epithelization of the channel along the suture at the newly opened medial end of the lower canaliculus.

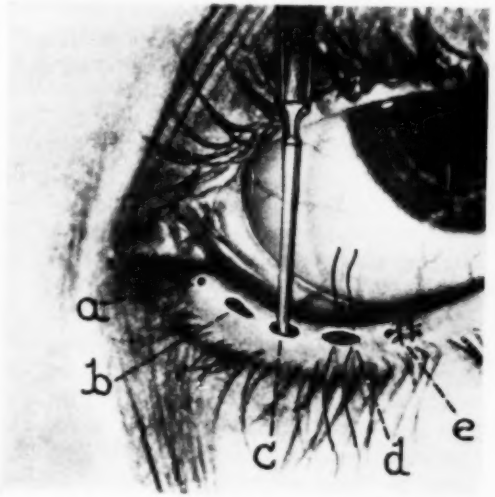


Fig. 9 (Hallum). Punctorrhaphy. (a) Normal punctum. (Added by artist): (b) Dilated punctum. (c) A cataract knife is used to denude the inner rim of the punctum, except its nasal portion. (d) Silk sutures have been placed across the margin of the lid, just deep enough to include the lips of the punctum. (e) After the sutures have been tied, the punctum is reduced to its normal size.

Report of Sixty Cases

Eight years ago it was decided to substitute dacryocystorhinostomy for extirpation of the lacrimal sac. Between January, 1940, and February, 1948, 60 dacryocystorhinostomies were performed, using the technique of Dupuy-Dutemps.

A follow-up has been obtained on 55 of these cases. Only one patient, the 21st operation in the series, reports no relief of pus or tearing, and refuses to return for examination. Her operation was uneventful four years ago at the age of 66 years, and my records show that at the first dressing normal saline solution was irrigated freely into the nose through the lower canaliculus. One other patient, the 13th operation in the series, who for four months had complained of epiphora only was not relieved. It was thought the stricture was in the naso-lacrimal duct, but it must have been a mistaken diagnosis, because at the recent follow-up examination six years after the operation, it was found that both upper and lower canaliculi were occluded to within 2 mm. of the puncti.

Six other patients were relieved of pus but were not completely relieved of tearing; in four of these patients the lower punctum was found at the follow-up examination to be dilated beyond normal size, one had had his lower canaliculus slit, and one had occlusion of the lower punctum. Punctorrhaphy (fig. 9) has been performed on two of the patients who had dilated lower puncta, and each has been completely relieved of tearing. In each of these cases the lower punctum was anesthetized by injecting a few minims of 1-percent procaine hydrochloride just anterior, and posterior, to the punctum. The tip of a cataract knife was used to produce denudation of the inner rim of the dilated punctum, except in the extreme nasal portion. A fine silk suture was placed across the lateral half of the punctum, from the anterior to the posterior lip, and left snugly tied for four days. In each of the two cases the decrease in tearing was immediate, that is, at the end of the operation.

Twelve of the patients were Negroes, seven of the patients had bilateral operations. Four of the patients who had bilateral operations were women, and three were men; all three of the men had bilateral con-

genital stenosis. There was only one patient who had unilateral congenital stenosis. The longest period of obstruction was 28 years —one of the men who had bilateral congenital stenosis. Thirty-five of the operations were done on the left side, and 25 on the right side.

Ten of the operations were done by the senior ophthalmic resident, under my direction, and all 10 operations were successful. Thirty-seven of the operations were performed under sodium pentothal intravenously and 23 under local anesthesia. Trauma was thought to be responsible for the obstruction in 10 of the patients; in one patient the obstruction developed after an antrum operation and the other nine followed blows on the nose, mostly in automobile accidents.

Two of the patients had external fistulas at the time of the operation, but they closed spontaneously after drainage into the nose was reëstablished. An abrasion of the cornea was produced in two patients; the abrasion healed in the normal time and without complications.

Conclusions

Dacryocystorhinostomy has given many surgeons the highest percentage of successful results when done by the technique popularly known as that of Dupuy-Dutemps. Extirpation of the lacrimal sac leaves tearing in a high percentage of the cases, but dacryocystorhinostomy by the technique of Dupuy-Dutemps should relieve both tearing and mucopurulent discharge in at least 95 percent of the cases of obstruction of the lacrimal duct and sac, if the lower punctum and lower canaliculus are normal. Even if the lacrimal sac is absent or completely occluded, tearing should be relieved by this operation in the majority of the cases. The postoperative treatment is usually limited to the care of the skin incision.

Excessive dilation of the lower punctum should be avoided, as it will result in tearing in an otherwise successful dacryocystorhinostomy. For this reason, the lower canaliculis should never be slit, and one should never pass a probe larger than a Bowman No. 2 or 3 lacrimal probe. A dilated punctum when partially closed by punctorrhaphy can be expected to relieve the accompanying tearing.

478 Peachtree Street, N.E. (3)

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OCULAR ONCHOCERCIASIS*

M. Puig Solanes, M.D., Bertha Riveroll Noble, M.D., and A. Fonte, M.D.
Mexico City, Mexico

Translated by George P. Guibor, M.D.
Chicago, Illinois

More than 30 years ago, ocular onchocerciasis was reported by Rodolfo Robles[1] and its clinical characteristics were described by Pacheco Luna.[2] Clinical material was accumulated by Fonte from data obtained at Huixtla, Chis., Mexico, in 1943; from records compiled by Puig Solanes, Fonte, and Quiroz[3] in the same locality in 1945; and from studies of Bertha Riveroll Noble[4] in the endemic zones of Guatemala.

Nearly all of the 1,334 cases examined by these investigators presented the characteristic nodules of onchocerciasis and possessed positive cutaneous biopsies. In a few cases, the existence of nodules could not be demonstrated and the cutaneous biopsies were not always positive. These patients, however, did present ocular lesions in the form of superficial punctate keratitis and iridocyclitis.

Only three complete globes and a number of fragments of corneal and conjunctival tissue were obtained for study by Noble[4] and Vargas de la Cruz.[5] Enucleation is unnecessary in most cases of ocular onchocerciasis, but delay in treatment has caused almost complete destruction of the globe, in some instances, before enucleation could be performed.

Strong[6] reported the incidence of ocular involvement in 5 percent of the cases in the Guatemalan zone, while Calderón[7] found ocular symptoms in 100 percent of the cases in the same zone. The disparity in these percentages results from the variation in susceptibility among individuals and the additional fact that, in those districts in which there are facilities for periodic examination and treatment, fewer eye infections occur. In addition, examinations performed in many rural districts without the aid of the biomicroscope do not reveal the existence of early ocular lesions.

In Africa, Hissette[8] found ocular lesions of onchocerciasis in from 43 to 51 percent of those infected, in the villages of the Belgian Congo, and we found 66.3 percent among the 1,334 patients examined in other zones.

Statistical studies made by us disclose that ocular involvement in onchocerciasis is not varied or influenced by the age of the patient or by the duration of the disease. A significant difference in incidence of infection of the eyes was noted in relation to the number of the nodules present regardless of size, 77.2 percent in those with more than five nodules and 60 percent in those with less than five nodules.

Strong[9] reported that, on his African expedition, ocular complications were particularly frequent in patients with small but numerous nodules (25 to 100). In the study of the susceptibility of various races to the disease, it was indicated that the Caucasian race is less susceptible than the races native to the Americas and to Africa and that those of mixed genesis show a definite predisposition to infection. There were more men than women infected.

Clinical aspects of onchocerciasis

Acute form

In the acute form of onchocerciasis, the skin and the eyes are severely affected. The hard, red swellings in the skin of the cheeks, eyelids, and about the ears (figs. 1 and 2) were diagnosed by Robles[1] "as erysipelas of the skin."

Ocular manifestations in the acute form are photophobia, blepharospasm, lacrima-

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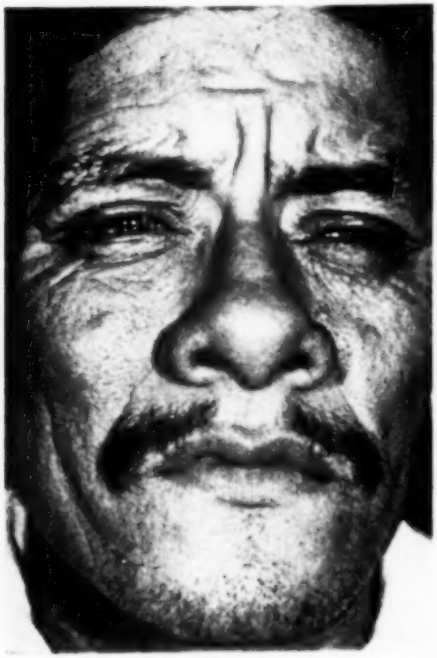

Fig. 1 (Solanes, Noble, and Fonte). Facial appearance in onchocerciasis.

tion, and injection of the anterior segment with edema between the superficial and deep tissues so great that on moving the globe, there is the appearance of a hyperplasia. The dermal irritation persists after the ocular symptoms have subsided but both reappear in the chronic form unless the skin is cleared of infestation.

THE CHRONIC FORM

The chronic form, the "true conjunctivitis of Calderon,"[7] existed in 22 percent of the cases of Puig Solanes, Fonte, and Quiroz. This form is characterized by vascularization and excessive pigmentation, resulting from small irregular granules in the epithelium. In the conjunctiva (fig. 3) are follicles resembling phlyctenules.

Corneal manifestations. Superficial punctate keratitis, the characteristic corneal lesion in onchocerciasis, appeared alone in 45 percent of the cases of Puig Solanes, Fonte, and Quiroz[3] and was associated with iridocylitis in 20 percent of the cases.

Pacheco Luna[2] described these opacities as being a fraction of a millimeter in size and numbering from 1 to 12 in the same cornea, scattered, generally, but sometimes coalesced near the limbus. The biomicroscope shows them to be of powdery consistency in the vicinity of Bowman's membrane.

Interstitial keratitis, reported by Calderón,[7] is now believed to be only aberrant lesions of the superficial type. Vascular keratitis was noted by Hissette[8] as vascularization of the corneal limbus enmeshed in a weblike structure resembling a true pannus.

Chronic manifestations of the iris. Iritis, in association with lesions of the cornea, was demonstrated in 20 percent of the cases of Puig Solanes, Fonte, and Quiroz.[3] Puig Solanes[10] described fibrinous iritis with

Fig. 2 (Solanes, Noble, and Fonte). Cutaneous lesions of onchocerciasis.

and without displacement of the pupil. Calderón[7] spoke of acute and chronic forms, while Hissette[8] called it "diffuse atrophy of the iris."

Excessive pigmentation is present, in this manifestation, with microscopic obliteration of the folds of the iris. Exudation may occur near the pupil with synechias in the lower portion of the membrane (fig. 4). Gonioscopic studies of Puig Solanes[11] of 30 eyes of patients with onchocerciasis disclosed that the root of the iris is affected.

Choroidal manifestations. Choroidal involvement is noted most frequently in Africa. Hissette[8] described it as a diffuse

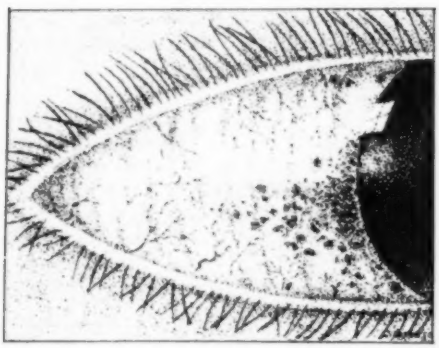

Fig. 3 (Solanes, Noble, and Fonte). Conjunctival alterations in onchocerciasis.

pigmented chorioretinitis with patches of atrophy.

Subjective symptoms

Subnormal vision. Visual acuity is decreased in ocular onchocerciasis principally from opacities in the cornea. There is, in the acute type, recovery upon removal of the nodules.

Other subjective symptoms. These symptoms may exist with or without the presence of objective lesions. The principal discomforts noted are the so-called conjunctival triad—fever, pain, and the sensation of a foreign body in the eye.

This triad is frequently linked with dancing lights, photophobia, entoptic vision of

Fig. 4 (Solanes, Noble, and Fonte). The effect of iritis in onchocerciasis.

active microfilaria, poor visual acuity, and lacrimation.

Diagnosis

Microscopic demonstration of the existence of microfilaria in the eye (fig. 5), positive cutaneous or conjunctival biopsies, and verification of the characteristic nodules constitute the general clinical diagnosis of onchocerciasis.

Parasites in the eye. Clark and Noble saw filariform bodies in the vitreous cham-

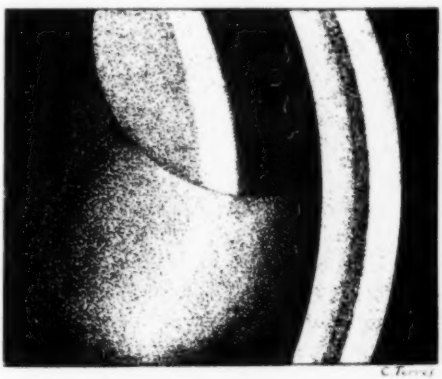

Fig. 5 (Solanes, Noble, and Fonte). Biomicroscopic representation of microfilaria in the anterior chamber.

ber but did not verify the type of filaria present. In 1945, Torres Estrada,[12] with the aid of intensive illumination and a lens of 20 to 25 diopters, demonstrated microfilaria as blackish filaments in the lower portion of the vitreous chamber.

Biomicroscopy of the eye. Torrella[13] first saw microfilaria in the anterior chamber of the eye by means of the biomicroscope in 1930. The parasites appeared to be refractive, thin, and to move about incessantly. The number varied from one to dozens and from day to day in the same patient. The parasites appeared to be phototropismic.

Biomicroscopy of the skin and the conjunctiva. Thin slices of the skin or of the conjunctival tissue are prepared for use with the biomicroscope in the usual manner with water or with whey. From 1 to 20 active microfilaria may be seen to 1 mm. of tissue. The number of microfilaria varies from day to day in the same individual. We found 16.3 per cent of our group with positive cutaneous biopsies and only 5 percent with positive conjunctival biopsies.

Examination of nodules in the skin

The nodules are of the greatest value in the diagnosis of onchocerciasis. They are from 0.75 of a millimeter to 3 or 4 cm. in size. They are hard, not painful, and are adherent to the skin. They are found most frequently about the head, on the American continent, in numbers not over 7 or 8. In Africa, the trunk and the limbs may show as many as 25 to 100 nodules in a single patient. The nodules may exist also in the outer canal of the ear, in the lining of the cheek, and over the aponeurosis of a muscle (Nettel[11]). The nodules are filled with a

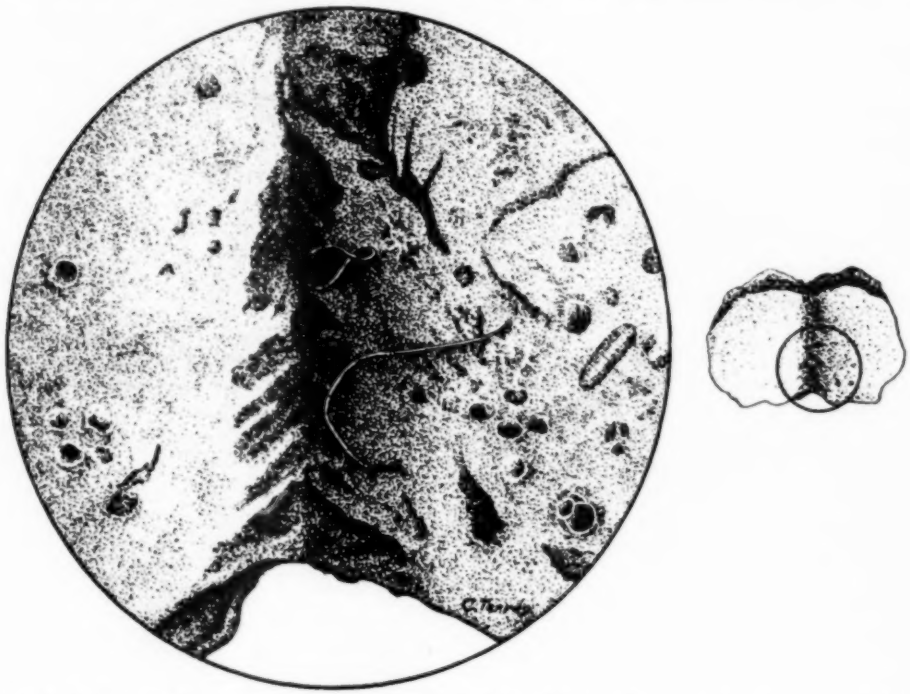

Fig. 6 (Solanes, Noble, and Fonte). A magnification of the adult parasites occupying the center of the mass of atrophied connective tissue in which the young are born.

turbid liquid containing active microfilaria which swim about a core of adult parasites enmeshed in connective tissue in a state of atrophy (fig. 6).

Histologic pathology

Octerena,[15] Hissette,[8] Strong,[6] and the authors[3] studied the histologic pathology of ocular onchocerciasis. Their conclusions were similar in most instances. The following are our conclusions:

1. The corneal lesions are superficial and exhibit much vascularization and pigmentation.

2. The activity of the microfilaria observed in the histologic preparations is comparatively small in relation to the extent and the number of the corneal lesions encountered.

4. Atrophy of the stroma of the iris occurs frequently.

5. The attack on the posterior pigmented portion of the epithelium and the dilator muscle is sufficient to explain the paresis of the pupil.

6. The ophthalmoscopic appearance of the choroidal atrophy and of dispersion of the pigment in the choroid is similar to the atrophy seen in the iris.

7. The retinal alterations seem to be secondary to the choroidal alterations and to exist principally in the outer layers of the retina.

Pathogenesis

The pathogenesis of ocular onchocerciasis can be accounted for by the action of toxins generated by the filaria in the nodules (Robles[1] and Pacheco Luna[2]). It is possible that the periodic reproduction of the females may bear some relationship to the toxins produced (Calderón[7]).

The traumatic action of the microfilaria in situ in the ocular tissues may result in much disturbance, especially if the nodule is near the eye and contains female adults which produce larvae every two months (Nettel[14]). We are of the impression that there are factors other than these which are still undiscovered.

The morbidity in ocular onchocerciasis may accrue also from the products of the metabolism of the adult parasite or of its larvae (Martinez Baez[16]). However, Hissette[8] was the first to discover the tenuous refractive filaments in the corneal parenchyma of patients. These are the dead microfilaria. Torres Estrada[12] considered that the lesions of keratitis centered in the vicinity of these dead bodies.

There is also much controversy over the manner in which the parasite enters the globe. The logical manner is from the external toward the deeper portions of the eye but Hoffman and Vargas[17] and Nettel[14] hold the theory that they proceed from some hidden nodule to the inner portions of the eye. Nettel[14] presented cases of patients with microfilaria present in the ocular chambers but none in the eyelids or in the subconjunctival tissues.

Prognosis

In general, the prognosis is not good. Microfilaria persist in the eyes months after the removal of the nodules from the skin. Considering the severity of many individual lesions, however, the visual acuity is good, especially in some of those cases in which there are many corneal opacities. In 45 of 61 cases there was visual acuity of 10/10 and in only 3, below 7/10.

Iritis in onchocerciasis, however, alters the vision considerably. The following percentages exclude incipient attacks of iritis, glaucoma, bulbar atrophy, and so forth, or of their sequelae. In iritis, there was visual acuity 10/10 in only two eyes of 22 examined, 1/10 in one of the eyes, 9 above 1/20 and 9 below 1/20. One eye was completely blind.

Treatment

The use of plasmoquina discussed by Torrella[13] has not proved permanently effective in the destruction of microfilaria.

Pacheco Luna has found surgical intervention disastrous in the treatment of affections of the iris.

The modern treatment of Bayer 205 (no reference given) would aid many if it were to prove generally as effective as it has proved in Africa.

We are of the opinion, however, after 10 years of systematic effort on the part of the sanitary ministers of Mexico and of Guatemala, that it has been proved that periodic examinations and removal of the nodules of onchocerciasis lessens the number of acute attacks and decreases the number of microfilaria in circulation. This reduces the probability of ocular infection.

Summary

A study of over 1,000 cases of onchocerciasis revealed an ocular infection in 60 to 77.2 percent of the cases. Caucasians were less susceptible, whereas those of mixed genesis were most susceptible.

Acute and chronic forms existed. In the former, the skin and the eyelids contained many papules.

In the chronic form, all tissues of the eye were infected, the cornea in 45 percent, iridocyclitis in 29 percent.

The diagnosis is made by: (1) The history of residency in the affected areas of Mexico, Guatemala, and Africa; (2) clinical signs and symptoms of nodules; (3) finding the microfilaria in the eye by slitlamp, and in the skin nodules by means of the microscope. The latter method is considered the most reliable.

Av. López Cotilla 811.

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OCULAR LYMPHOMAS*

PARKER HEATH, M.D.
Boston, Massachusetts

Ocular malignant lymphomas are uncommon. Hyperplasia of lymph and reticular tissue, however, is a common reaction to infection. Lymphoid elements are widely distributed under and in the conjunctiva of lids and globe, in the lacrimal gland, and in the lymph drainage system. The wide distribution and ready mobilization cause the borderlines of hyperplasia and malignant new growths to be far from sharply drawn. The lymph cells, however, even though they may undergo marked changes when they become neoplastic, still will tend to reproduce the cell of origin. This permits a classification based upon the principal cell types.

The purposes of this study of a significant series of ocular lymphomas are: to report the incidence, to classify the cases studied clinically and according to the principal cell types, and to report separately on both the incidence and the results of treatment of conjunctival lymphomas.

The material for this series was obtained from Massachusetts General Hospital, Collis P. Huntington Memorial Hospital, and the Massachusetts Eye and Ear Infirmary. Sixteen hundred records of patients with lymphomas of all varieties were consulted from the three institutions.

Ophthalmic literature, in contrast to that of general medicine, has scanty references to lymphomatous disease. Detailed reviews of the literature have been made by Shannon and McAndrews,[1] Leinfelder and O'Brien,[2] Ennema,[3] and McGavic.[4] Case reports on reticulum-cell sarcoma of the conjunctiva have been made by Siotto,[5] Black,[6] and Rados.[7] Verhoeff and Derby[8] report a case of plasmoma of the lacrimal sac and cite nine other cases reported. Because of the rarity of ocular lymphoma, most reports are made from small series. Ophthalmologists in general see but few of these patients. Laboratory reports are often confusing. The variety of early clinical signs and the irregular periods of remission of the disease combine to obscure further both reports and satisfactory classifications. One would expect this in a disease of unknown etiology and such wide variance in clinical manifestation. The reports in medical literature reflect this by showing variegated classifications, terminology, and conclusions. The matter of etiologic agent is not considered in this paper.

Clinically, the lymphomatous lesions are usually painless, moderately firm and vascular, and slow in growth. When presenting under a mucous membrane they appear grayish pink and yellowish pink to red and show coarse vessels superficially. Early stages may somewhat resemble a firmer kind of lipoma. They range in size from small, firm, discrete nodules in lid, globe, or orbit, to diffuse masses of tissue encircling the globe or involving the lids and found within both orbits. Biopsy removal and microscopic examination is of greatest value in diagnosis.

A clinical classification can be made based upon the appearance and the course of the growth as follows:

1. Benign hyperplastic node, located usually episcleral or subjunctival behind the lower or upper lid. It is a smooth-surfaced, fleshy nodule, yellowish pink in color without signs of inflammation. These often remain the same size for years, are sometimes congenital, but may develop malignant qualities, especially in the first and after the fifth decade of life.

2. Locally diffuse: (a) conjunctival or subconjunctival, grayish in color, somewhat

* From the Massachusetts Eye and Ear Infirmary. Presented at the 84th annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, May, 1948.

soft, gelatinous clusters of lymphoid tissue, with limited growth; very sensitive to X rays and not likely to recur; (b) this group is benign, at first lymph-cellular, later a fibrous, scirrhous, lymphoid hyperplasia involving lacrimal gland and lids, and the orbit in a self-limited extension; the "pure" form of Mikulicz's disease (Heath[9]).

3. Associated ocular lymphoma, eye involvement as part of general disease, leukemia or Hodgkin's and of the hematopoietic system including spleen, bone marrow, and lymph nodes, and liver. Small lymphomas may be found in skin, episclera, subconjunctiva, and orbit. As a rule these nodules become invasive relatively slowly. When the limbus is involved, there may develop a superficial pannus and red fleshy corneal overgrowth with rare superficial hemorrhages. The insertions of the recti muscles or the plica and caruncle may be the sites of nodules. These nodules are composed of mature lymphocytes and of lymphoblasts showing a moderate reticulum and a stroma carrying blood vessels and capillaries.

4. Invasively diffuse: first seen as an ex-

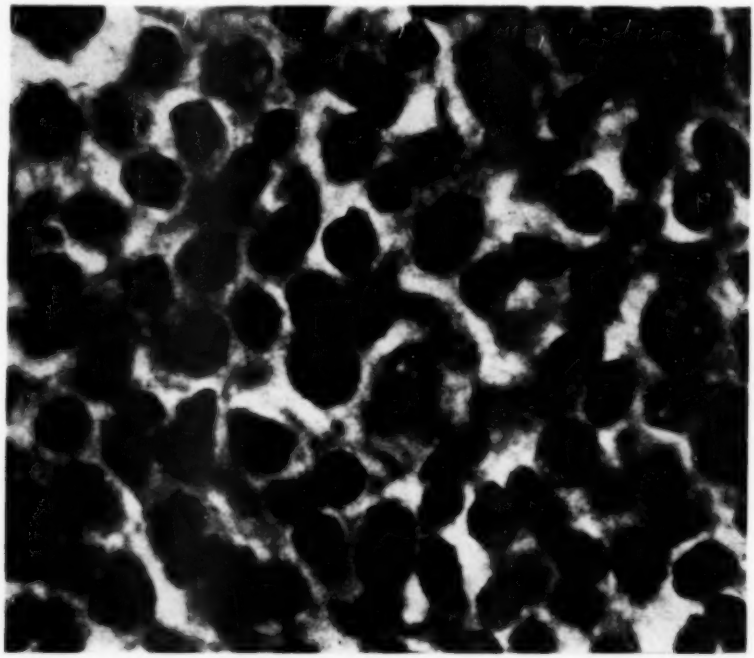


Fig. 1 (Heath). Lymphoblastoma (×1,200). Larger (9 to 20 micra) than mature cell; finely divided chromatin in single nucleus with well-defined borders. Narrow border of cytoplasm; no increase in reticulum.

Fig. 2 (Heath). Lymphocytoma (×1,200). (7 to 10 micra.) Dense mass of chromatin in nucleus; narrow cytoplasm. No increase in reticulum.

Fig. 3 (Heath). Reticulum cell (×1,200). (10 to 20 micra.) Abundant cytoplasm. Ovoid nucleus, chromatin fine in mature, coarse in immature. Prominent nucleolus, may be binuclear. Ameboid activity. Reticulum increased.

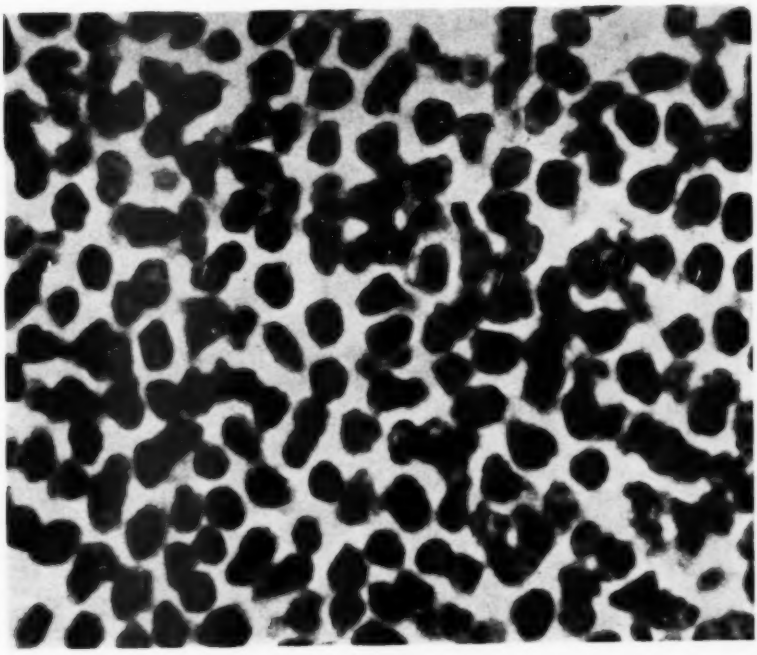


Fig. 2

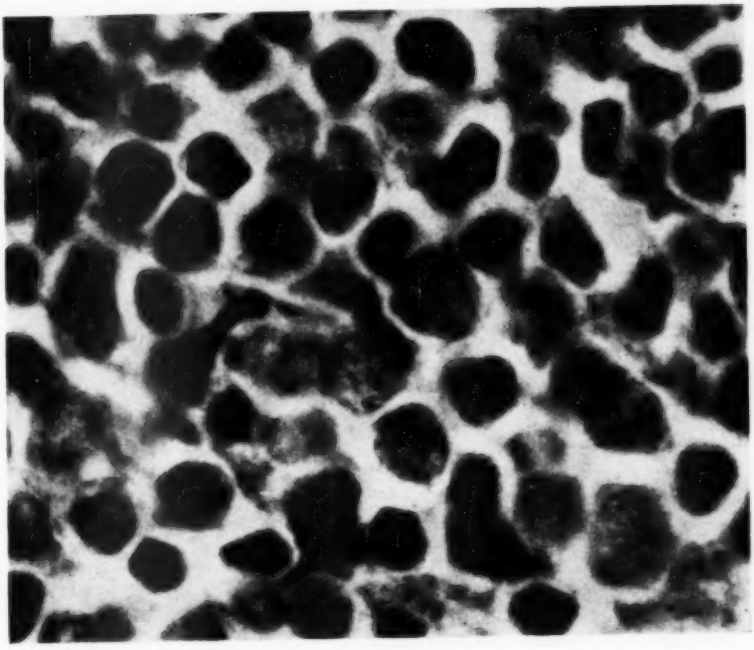


Fig. 3

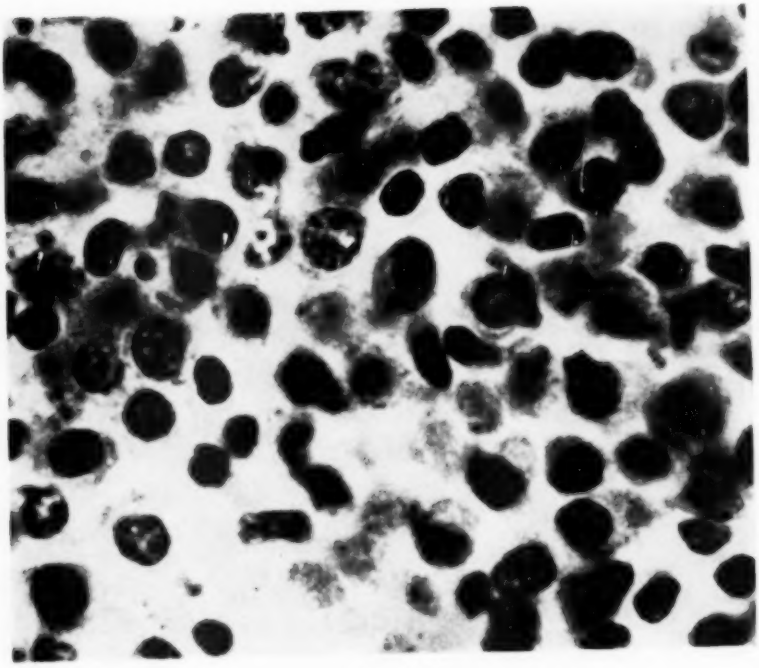


Fig. 4

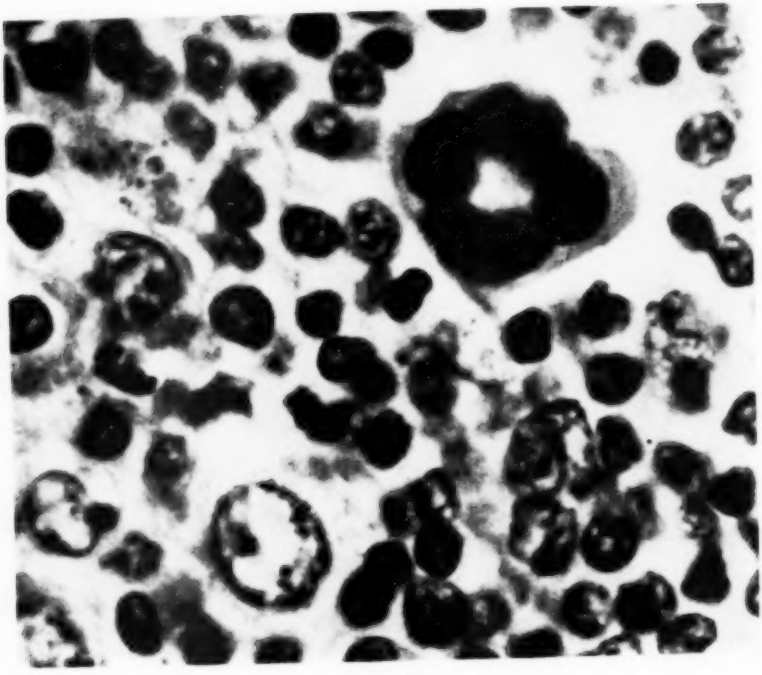


Fig. 5

panding, grayish pink, firm to hard, bulbar, subconjunctival, lid or orbit new growths, sarcomatous, and invasive by lymph channels; may be derived from group (1) or (2a) if the local process shows mature cells which have become more primitive and invasive. The conjunctival and subconjunctival red encircling swelling is firmly attached to the globe and has somewhat the appearance of a brawny scleritis and some superficial capillary hemorrhages may be noted. When it occurs in the lid, an extensive firm edematous swelling is noted to be associated with a deep smaller nodule which is both opaque and shows frayed edges on transillumination. The process resembles at first inspection an acute chalazion with edema, but has less hyperemia; the vessels are fewer and coarser and small hemorrhages may be noted. The swollen lid is firmer and gives less pain to the patient on palpation than chalazion. A biopsy, which should include part of the nodule, may show a reticulum-cell lymphoma.

This report uses the classification developed by Sparling, Adams, and Parker (Table 1).[10] It survives the test of usefulness in predicting the clinical course of the disease. The cells of the lymph structure used in the classification are: lymphoblasts, mature lymphocytes, the reticulum cell, and the plasma cell.

TABLE 1*

Cell type	
Lymphoblast	Lymphoblastoma
	Lymphosarcoma, lymphoblastic type
	Lymphatic leukemia
Lymphocyte	Lymphocytoma
	Lymphosarcoma, lymphoblastic type
	Lymphatic leukemia
Giant Follicle Lymphoma	Reticulum cell sarcoma
	Hodgkin's granuloma or sarcoma
	Lymphosarcoma
	Lymphatic leukemia
Reticulum cell or Histiocyte	Reticulum cell sarcoma
	Hodgkin's disease: Paragranuloma
	Hodgkin's disease: Granuloma
	Hodgkin's disease: Sarcoma
	Histiocytic leukemia
Plasma Cell	Plasmacytoma
	Multiple myeloma
	Plasma cell leukemia

* From Sparling, Adams, and Parker.[10]

When local lymph tissue extends and invades, it is called sarcomatous, and when found in the blood it is called lymphatic leukemia; the presence of Reed-Sternberg cells makes the diagnosis Hodgkin's disease. Table 2 gives cytologic detail. Four cell types are illustrated by photomicrographs selected from this series, a fifth to depict Hodgkin's disease.

Sixty-seven cases of ocular lymphoma

Fig. 4 (Heath). Plasmoma (×1,200). Plasmocytoma (2 to 12 micra). Polygonal or triangular outline. Nucleus round, eccentric. Chromatin masses in the periphery. Basophilic cytoplasm. No increase of reticulum.

Fig. 5 (Heath). Hodgkin's disease. Always shows Reed-Sternberg cells (10 to 40 micra). Pleomorphic nucleus, sometimes lobulated and multinuclear. Nucleoli common, large clumps of chromatin. The Reed-Sternberg cells are the large multinuclear cells.

TABLE 2

CYTOLOGIC DIFFERENTIATION

	Size	Nucleus	Cytoplasm	Reticulum	Mitosis	Necrosis	Local	Invasive
Lymphoblast	9 to 20 micra	Larger than mature cell. Border well defined; finely divided chromatin dispersed in nucleus. Single	Narrow; border may stain basically	Not increased	Rare	Rare	Lymphoblastoma	Lymphosarcoma of lymphoblastic type
Lymphocyte	7 to 10 micra	Dense; massed chromatin	Slight; basic	Not increased	Rare	Rare	Lymphocytoma	If in blood, lymphatic leukemia. Lymphosarcoma of lymphocytic type
Giant follicle Lymphoma	Many separate or fused large follicles with active germ centers. Usually limited to lymph nodes and spleen		Germ centers contain young lymphocytes or reticulum cells				Border zone of mature lymphocytes	Half develop Hodgkin's or sarcoma
Reticulum cell	10 to 20 micra	Ovoid, one side often indented; fine chromatin if mature, coarse in young cells and with nucleolus prominent. Occasional binuclear	Abundant acid or basic. Some ameboid activity	Increased				Tend to invade veins, arteries
Hodgkin's Sarcoma form is mostly histiocytes	18 to 30 micra	Variable cell mixture, lymphocytes, reticulum and plasma; some eosinophiles, polymorphonuclears Always Reed-Sternberg cells 10 to 40 micra. Pleomorphic nucleus, sometimes lobulated, multinuclear cells. Chromatin in large clumps and common nucleoli	Fine reticulated cytoplasm, acid or basic	Increased Common		Usual (except paragranuloma type)	Loss of nodal architecture (limited extent in paragranuloma)	Paragranuloma not invasive. Granuloma may change over to sarcoma
Plasmacytoma	1 to 12 micra Polygonal or triangular outline	Round, eccentric, heavy chromatin masses at periphery	Basophilic	Not increased	Common	Rare	May remain local for many years	May involve bones and viscera

are reported in this series. Their site classification may be seen in Table 3. In the grand total of lymphoma patients the percentage of involvement of the eye is 4.0. These patients were referred by an active clinic especially interested in this disease. In a recent study of 288 patients at the Massachusetts General Hospital Lymphoma Clinic, 1.7 percent were classified as presenting lymphoma in the orbital adnexas.

Graph 1 shows the age and incidence of all lymphomas in this series and separately those of the conjunctiva, and thus permits a comparison.

Treatment

The treatments usually employed for the lymphomas are: surgical extirpation and roentgen ray, or both. Lymphoma tissue is by and large susceptible to small dosage of

TABLE 3

Classification of cases

Site	Number	Site %	Cell Types			
			Lymphocyte	Lympho-blast	Plasma	Reticulum Cell
Conjunctiva	30	44.7	20 Giant follicle 1	5	1	3
Lid	13	19.4	5	7		1
Lacrimal gland	2	2.9	1	1		
Sclera	1	1.4	1			
Globe	3	4.4	2		Lymphatic leukemia 1	
Orbit	14	20.8	8	5	1	
Combined site	4	5.9	3 Giant follicle 1			

In the McGavic[4] series of 21 cases, lymphoma accounted for 2.6 percent of the extrabulbar tumors, and Rones[11] found only 19 lymphomas in 11,500 ocular specimens of all kinds of diseases at the Army Medical Museum, and of these, three, or 0.025 percent involved the conjunctiva. At the Massachusetts Eye and Ear Infirmary Eye Pathology Laboratory, lymphomas of the conjunctiva represented 1.8 percent and lymphomas of the orbit 0.84 percent from approximately 1,671 tumors of all kinds and types, original in the ocular adnexa. These comparisons may be seen in Table 3.

In the conjunctival lymphomas, correlation of age, cytology and the aftermath of treatment may be seen in Table 4.

X rays. The usual technique of treatment in recent years (Massachusetts General Hospital) has been 200 kv., 20 cm. object-target distance, ¼ mm. copper filter, and daily doses of 200 to 300 r directed onto the conjunctiva for a total of 600 to 900 r. This has not resulted in any untoward effect upon the eye, immediate or remote. (One eye with an orbital lymphoma, not included in the present study, which received 1,200 r has developed an opacity of the lens five years after treatment.) The more scirrhous a lymphoid lesion, as in Mikulicz's disease, the less susceptibility is present. X ray sensitivity is variable enough to be used as a differentiating agent in diagnosis.

Excision is also recognized as good treat-

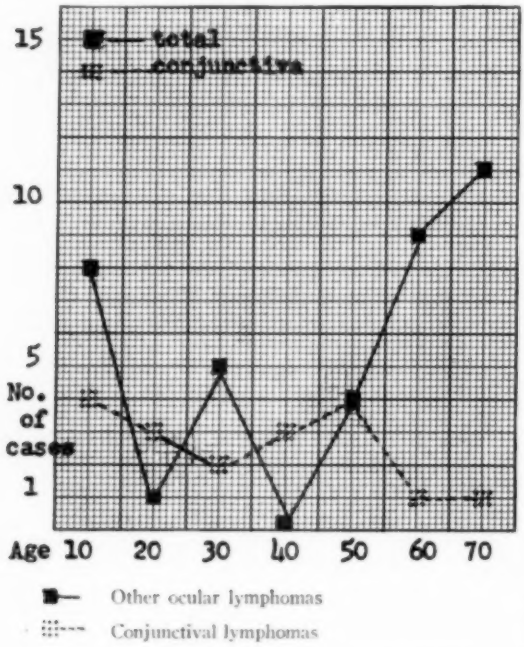
TABLE 4

LYMPHOMATOUS TUMORS OF CONJUNCTIVA—CORRELATION OF AGE, CYTOLOGY, AND AFTERMATH OF TREATMENT

Case	Sex	Age	Pathologic Diagnosis	Cell Type	Presenting Symptom	Duration on Admission	Local	Not Local	Treatment	Results	
										Status	Duration Post Rx
E-47-158	F.	38	Lymphoma	Lymphocytoma	Conjunctival infiltration	2 months	x		Excision 800 r	Well; slight conjunctival injection	½ year
9-12,812 (MGH 44-7482)	F.	70	Lymphoma	Lymphocytoma	Conjunctival infiltration	?	x		Excision	Well	3½ years
8-12,452	F.	68	Lymphosarcoma	Lymphocytoma with a number of reticulum cells	Conjunctival infiltration	1 year	x		900 r	Well	5¼ years
9-12,929 (MGH 44-7482)	M.	60	Lymphoma	Lymphocytoma	Conjunctival infiltration	4 years	x		600 r	Well	3 years
9-13,034	M.	53	Lymphosarcoma	Lymphoblastoma	Conjunctival infiltration	1 year	x		1,000 r	Well	3 years
8-12,406	F.	58	Lymphosarcoma	Lymphocytoma	Conjunctival infiltration	3 months	x		1,000 r	Well; chronic blepharitis	5½ years
4-6,183	M.	78	Lymphosarcoma	Lymphocytic sarcoma	Tumor mass	1 month	x		Radium 58 mgh.	Dead without disease	2¼ years
E-47-29	M.	55	Lymphoma	Lymphocytoma and lymphoblastoma	Conjunctival infiltration; generalized	3 months		x	600 r	Alive with disease; spleen large	½ year
3-5,188	M.	8	Reticulum cell	Reticulum cell	Tumor mass; orbit involved	2 weeks		x	Exenteration 300 r Radium ++	Lost with disease	¾ year
4-8,209	F.	87	Lymphosarcoma	Lymphocytoma Many histiocytes	Tumor mass; cervical nodes	1 year		x	Exenteration	Dead with disease	1¼ years
MGH 47-9876	F.	82	Lymphoma	Reticulum cell	Tumor mass	3 months	x		X-ray	Well	¼ year
MGH 32-848	M.	71	Lymphosarcoma	Lymphocytoma	Tumor mass; generalized	4 years		x	Excision X-ray	Dead with disease	1¾ years
6-10-426	M.	76	Lymphosarcoma	Lymphocytoma	Conjunctival infiltration; generalized	3 months		x	600 r	Dead with disease	½ year

3-2,686	M.	22	Plasmoma	Plasmoma	Tumor conjunctiva	?	x		Excision	Unknown	?
2-692	M.	16	Lymphoma	Lymphocytoma	Conjunctival infiltration	?	x		Excision	Unknown	?
8-12,024	F.	41	Lymph node	Lymphocytoma	Tumor mass	?	x		Excision	Unknown	?
7-10,601	M.	64	Lymphoma	Lymphocytoma	Thickening conjunctiva	7 years	x		Excision X-ray	Well	$\frac{1}{4}$ year
5-8,482	F.	48	Lymphoma	Lymphocytoma	Tumor mass	2 months	x		Excision	Unknown	?
7-11,528	F.	?	Lymph follicle cysts	Lymphoblast	Cysts in conjunctiva	?	x		Excision	Well	7 years
7-11,120	M.	?	Lymphoma	Lymphocytoma	Conjunctival infiltration	?	x		Excision	Unknown	?
2-1,802	M.	?	Lymphoma	Lymphoblastoma	Unknown	?	x		Excision	Unknown	?
E-48-91	M.	28	Lymphoma	Reticulum cell	Conjunctival infiltration	?	x		Excision	Well	$\frac{1}{4}$ year
8-12,407	M.	67	Lymphosarcoma	Lymphocytoma	Irritation conjunctiva	Several months	x		Excision X-ray	Well	3 years
8-11,878	M.	34	Lymphoma	Lymphoblastoma	Conjunctival infiltration; nose involved	1 year	x	x	Excision X-ray Exenteration	Dead with disease	9 month
7-11,260	M.	7	? Boeck's sarcoid Lymphocytoma	Lymphocytoma with plasma cells	Conjunctival infiltration	?	x		Excision	Unknown	?
E-47-21	M.	42	Lymphoma	Giant follicle lymphoma	Drooping lid	3 months	x		Excision X-ray	Well	1 year
MGH 44-7310	M.	?	Lymphoma	Lymphocytoma	Conjunctival infiltration	2 years	x		Excision	Unknown	?
2-1,460	?	?	Lymphoma	Lymphoblastoma	Conjunctival infiltration	?	x		Excision	Unknown	?
3-4,729	?	?	Lymphoma	Lymphocytoma	Conjunctival infiltration	?	x		Excision	Unknown	?
4-5,453	F.	55	Lymphoma	Lymphocytoma	Conjunctival infiltration	?	x		Excision	Unknown	?

ment of conjunctival lymphomas. The lid and orbit growth may be treated both surgically and with X ray, dependent upon size and location. The aim may well be: (1) Complete surgical removal; (2) microscopic examination of the specimen; (3) further treatment by surgery and X ray, or only by X ray as indicated by the nature of the site, size, and microscopic examination in the pathology laboratory.



Graph 1 (Heath). Age incidence of conjunctival lymphomas versus other ocular lymphomas.

The effects of various treatments in this series, other than the conjunctival, are difficult to classify accurately, because of the gaps in the follow-up history. We may say in general that those patients who have an involvement of the eye as a part of a generalized lymphoma have an average outside prognosis of two years. The local ocular treatment, however, has usually prevented recurrent involvement of the eye itself, even when extension has occurred elsewhere. This is true even when the eye and adnexa were secondarily involved by extension. When the disease is localized, as in the conjunctival group, a remission may be sufficiently long to carry the patient through his usual age expectancy. In two cases in the conjunctival series the patient was untreated for four years. One is alive and one is dead. It just happens that in our series there have been no leukemic blood changes in the conjunctival lesions alone. This agrees with the reports of others (McGavic,[4] Rones,[11] Verhoeff,[12] and Bedell[13]).

Summary and Conclusions

The most common cytology in this series is the lymphocytoma. There are noted, however, other cell types, that is, lymphoblastoma, reticulum cell, and plasma cell. Prognosis is not materially altered by cell type. The lymphomas occur more often in the first decade and after the fifth. They respond to X-ray treatment in small doses and to excision when size permits. Long periods of remission may follow treatments. Lymphomas of the lid and orbit are like those elsewhere. If early, small, discrete, and primary, the immediate effects of removal and X-ray therapy are good, the remote poor.

The conjunctival part of this series offers similar findings to that group of lymphomas reported before by Schulz and Heath,[14] namely, that the primary lymphomas of the orbit and conjunctiva are rare and were responsible for less than one percent of a total group of 1,671 ocular tumors. The primary conjunctival lymphomas are relatively benign, if there has been no extension of the process at the time of treatment. A long interval may elapse before general involvement takes place. If the conjunctival lesion is extending and sarcomatous, the prognosis is—in time invariably fatal.

243 Charles Street (14).

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FUSIONAL VERGENCE*

EDWIN FORBES TAIT, M.D.
Norristown, Pennsylvania

It has long been recognized that ocular comfort and visual efficiency in individuals with binocular vision depend not only upon the neutralization of refractive errors, if present, but also upon the precision with which the visual axes of the two eyes can be directed toward the object of regard. While binocular fixation deficiencies are by no means as common as refractive errors, they are frequently the major cause of difficulty in a large proportion of the groups of individuals who are collectively considered as refraction problem cases.

Considerable attention has been given to the development of methods for measuring, designating, and classifying the end effects upon the extraocular muscles of the stimulus-response mechanisms concerned with binocular vision. The various forms of heterophoria and heterotropia have been familiar to every ophthalmologist since the time of Stevens[1] and Maddox. Relatively little work, however, has been done on the identification and classification of the stimuli which, through the operation of reflex arcs, produce the binocular ocular rotations as responses to the various stimuli.

The present paper reports one of a series of studies on the stimulus-response mechanisms in these ocular vergences.

Although Donders,[2] in his epoch-making classic on refraction and accommodation of the eye, was the first to point out the necessity of coördinated accommodation and convergence in binocular vision, and Helmholtz,[3] a few years later, reaffirmed and amplified his viewpoint, it was not until Maddox,[4] presented the results of his studies of convergence that the importance of the afferent side of the stimulus-response process was recognized. Maddox, however, was unable to develop his concepts fully, as he lacked the essential understanding of the reciprocal innervation-inhibition of opposing muscle groups, which was supplied some years later in Sherrington's[5] work on the integrative action of the nervous system.[5]

In 1917, Sheard[6] amplified Maddox's ideas, and presented a report on a study of the three reflexes then considered to be re-

* From the Department of Ophthalmology, Temple University Medical School. Presented before the College of Physicians of Philadelphia, Section on Ophthalmology, December 18, 1947.

sponsible for binocular fixation. These were designated as tonic convergence, accommodative convergence, and reflex or fusional convergence. A few years later, a fourth stimulus for convergence was added, that of proximity, or the sense of nearness, and the convergence resulting from that stimulus has been designated as proximal convergence.

Ophthalmic literature is singularly barren in statistical studies showing the distribution and range of these functions. This is probably due to the general acceptance of some widely held but, unfortunately, inaccurate ideas as to the meaning of the results obtained by the binocular balance tests. In many quarters heterophoria is still considered to be an expression of the strength of opposing muscles, rather than the result of faulty reciprocal innervation to those muscles. Again, prism convergence or divergence tests are thought to indicate muscle strength and they are often considered to be faulty when the relationship between prism convergence and prism divergence is not three to one, respectively. Other workers are much distressed if an apparent excessive exophoria at near is found.

In 1942, the Dartmouth group[7] presented the results of a survey of the ocular functions of a large number of students in the course of a study of the influence of visual factors upon motivation. Included in this survey are the results of tests of prism convergence and divergence and reversion to fusion, and the values agree fairly well with those found in the present study. The conclusions as to the meaning and use of the data, however, vary widely from those presented herein.

The distribution of the results in the present study and an interpretation of the facts presented in other investigations of convergence indicate that the vergence functions are the result of reflex conditioning, such as is encountered in any learning process. The conclusions of Chavasse[8] support this concept.

The present report is concerned with the range of modifications in the position of the visual axes of the two eyes, relative to each other, occurring as the result of the efforts of the individual to retain, or to gain, single binocular vision. These efforts may be collectively known as fusional vergence, or, more precisely, as fusional convergence or fusional divergence, supra- or infravergence and cyclovergence.

While the data upon all of these fusional processes has been obtained in several thousand individual studies, from which the 500 considered in this report were drawn, because of limitation of time and space only the lateral vergences, relative to distance fixation, will be presented.

Investigative work in accommodation and convergence must be confined largely to statistical studies of fairly large selected groups, or to intensive studies of the accommodation and convergence reactions of single individuals. Both types of inquiry are necessary for the advancement of knowledge in this field, with perhaps the former being the more applicable to correlation with clinical observation and diagnosis. Animal experimentation can obviously contribute little, as clear single binocular vision, or its absence, can be determined only by subjective reports.

The fusional process, sometimes called the fusion faculty, or simply fusion, is a two fold entity. It is generally considered to be not only the anatomic and physiologic arrangement which permits the superimposition in the visual cortex of the sensory impulses arising in the two retinas, thus making possible single binocular vision and stereopsis, but also a stimulus-response mechanism whose duty it is to keep the object of regard on the proper corresponding retinal points or areas by means of reflex control of the extraocular muscles.

The first function of the fusional process, as outlined above, is concerned entirely with sensory perception and is that which should properly be designated as "fusion." All

cases reported in this study have good single binocular vision and stereopsis and thus have normal sensory fusion.

The second function of the fusional process, that in which there is a varying of the position of the visual axes of the eyes in order to retain or gain single binocular vision, should be considered as fusional vergence.

While these two functions are interrelated and interdependent, only the second will be considered in this paper.

Fusional vergence may be defined, therefore, as a modification produced by the fusional process in the distribution of tonic reciprocal innervation to the extraocular muscles, in order to preserve or to gain single binocular vision.

Fusional vergence, through the years, has been variously known as positive and negative fusional convergence, binocular adduction and abduction, prism convergence and divergence, ability to overcome prism, and prism vergence. Although the terms "adduction" and "abduction," originally introduced by von Graefe as a designation for the fusional convergence and divergence, are convenient, in recent years some writers have confused binocular and monocular duction terminology, so that it is probably desirable to use the more descriptive and accurate general designation of fusional vergence, which term can further be modified by describing the means, such as prism, or haploscope, used in the determination.

In all such studies, it should be kept in mind that the values obtained are relative to the means employed in the study and to the stimulus conditions. Thus a study of the fusional reflexes with prisms, and with stimulus objects of given intensity and at certain distances, would differ somewhat from fusional values obtained by the use of movable stereoscopic apparatus, such as a haploscope. In any type of investigative or clinical procedure, the normal distribution, with respect to the circumstances of the test, must first be ascertained, after which departures from the usual value can be recognized and evaluated. In the present study, an effort is made to determine the normal distribution of values of the lateral vergence reflexes under certain rigidly controlled conditions.

The 500 cases reported in this paper were taken at random from a much larger group of individuals who have clear, comfortable, and efficient single binocular vision and who were wearing suitable glasses, if they were needed. The only limitation to selection was that, for convenience, only subjects with less than 2^{Δ} of esophoria or exophoria were included. When lateral heterophoria of greater amount is present, it becomes necessary to calculate the fusional vergence amplitude by including a correction for the esophoria or exophoria. Such cases, however, introduce an additional factor in comfortable vision, that of the constant presence of a considerable amount of fusional vergence effort necessary to maintain single binocular vision for distance, and these patients will be given separate consideration in a later paper.

In the series of procedures used in the present investigation, the object was a 6/30 letter, black on translucent base, and illuminated from behind with an illumination equal to 10 foot-candles at the plane of the letter. The prism values, base-in and base-out, were supplied by means of the Risley prisms in a standard phorometer. In the prism convergence break tests, prism power was increased before each eye simultaneously, making an effort to keep the increase equal in the two eyes, and with a speed of about 4^{Δ} per second. No attention was paid to the blurring of the stimulus object, but the prism dioptry value just before the patient reported that the object separated into two was recorded. At the speed of increase already noted, this procedure permitted an ample allowance for reaction time in practically all cases. Inasmuch as the accuracy in reading the Risley prisms is somewhat less than 1^{Δ} when both prisms are used, the

value obtained in the test was recorded in the distribution in the next lowest group. Thus, the two chief variables, the patient's reaction time and the experimental variations in reading the prism calibrations, were compensated for reasonably well.

The same procedure was carried through in the prism divergence test, except that the prisms were increased in the base-in direction.

After the prism convergence value was obtained by the break-point test, the patient, of course, had diplopia and, in nearly all cases, seemed to fix with one eye, probably the dominant eye. In the remaining few, there was alternation of the eyes in macular fixation of the object. With the patient observing the diplopic images, the prism base-out power in the prism convergence test was gradually decreased at a somewhat slower rate than it had been increased, and the patient was encouraged to tell just as soon as he could see one object only. As soon as he reported that the two images had fused into one, the value was noted, and the value recorded in the next lower group, in order to allow for the errors already discussed.

The same procedure was carried through in the prism divergence reversion to fusion test. In each case, the results represent the average of at least three trials. It was rare, however, for several trials to vary more than 2$^{\Delta}$. In other words, the tests are satisfactorily repeatable.

Table 1 shows the distribution of these 500 cases on the prism convergence break and reversion to fusion tests. Table 2 presents the data obtained in the same group of cases in the prism divergence break and reversion to fusion tests. Figure 1 presents the percentage of subjects who failed to maintain fusion in each group during the prism convergence break tests. The reversion to fusion line in the prism convergence graph represents the percentage in each group who failed to obtain fusion as the prism power is reduced. Figure 2 presents the same data relative to the prism divergence break and reversion to fusion tests.

These data show that in a group of 500 subjects, as prism convergence is increased, more persons will fail to maintain fusion. At 26$^{\Delta}$ to 28$^{\Delta}$ only 10 percent can still maintain fusion. Of these few, some can overcome as much as 38$^{\Delta}$ to 40$^{\Delta}$. The midpoint of the range is about 18$^{\Delta}$ to 20$^{\Delta}$. In other words, about half the patients could overcome as much as 18$^{\Delta}$ to 20$^{\Delta}$ of prism convergence and still maintain fusion.

TABLE 1

PRISM CONVERGENCE: DISTRIBUTION OF 500 CASES OF ADULTS OF PRESBYOPIC AGE

Prism Dioptries	Break	Reversion to Fusion
2–4	0	204
6–8	20	167
10–12	121	71
14–16	107	38
18–20	126	10
22–24	58	6
26–28	22	4
30–32	26	0
34–36	10	0
38–40	10	0

Values recorded in next lowest prism dioptry group.

TABLE 2

PRISM DIVERGENCE: DISTRIBUTION IN 500 CASES OF ADULTS OF PREPRESBYOPIC AGE

Prism Dioptries	Break	Reversion to Fusion
2–4	8	328
6–8	101	128
10–12	208	28
14–16	133	16
18–20	47	0
22–24	3	0

Values recorded in next lowest prism dioptry group.

With prism divergence, half of the subjects cannot maintain fusion with as much as 12$^{\Delta}$ to 14$^{\Delta}$. Ten percent can go as far as 18$^{\Delta}$ to 20$^{\Delta}$. Some can go as far as 22$^{\Delta}$ to 24$^{\Delta}$.

After the break and consequent diplopia, the prism power is reduced until eventually

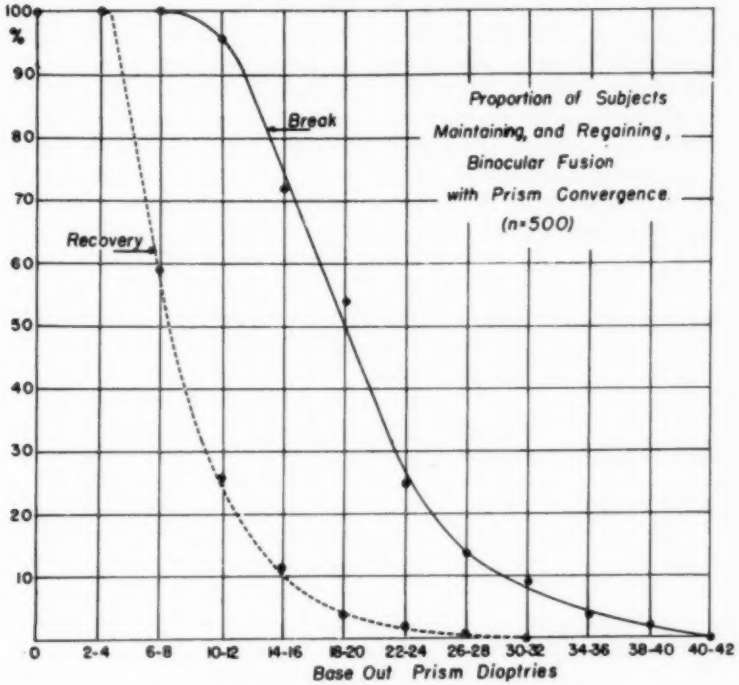

Fig. 1 (Tait). Prism convergence (500 subjects).

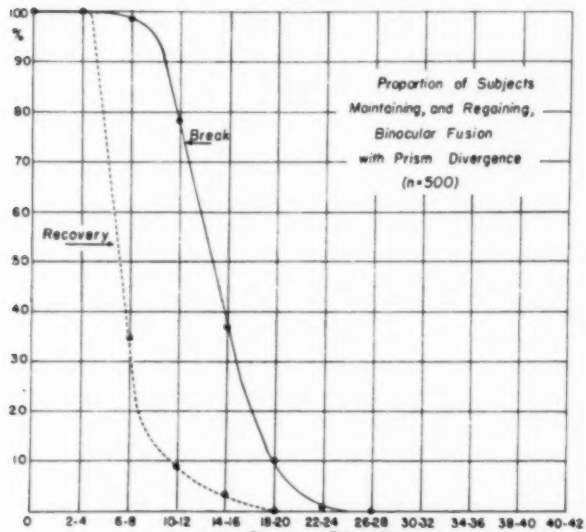

Fig. 2 (Tait). Prism divergence (500 subjects).

the fusion is regained. This occurred in all cases before the prism power was reduced to zero. Apparently the act of stimulating an area outside of the immediate perimacular area with an image similar to that stimulating the other macula (of the fixing eye) results in a change of fixation and reversion to fusion. The probability of this reversion increases as the prism power approaches zero. With prism convergence, over 10 percent of the patients will regain fusion when 10^{Δ} to 12^{Δ} remain, and 100 percent have regained fusion at 2^{Δ} to 4^{Δ}.

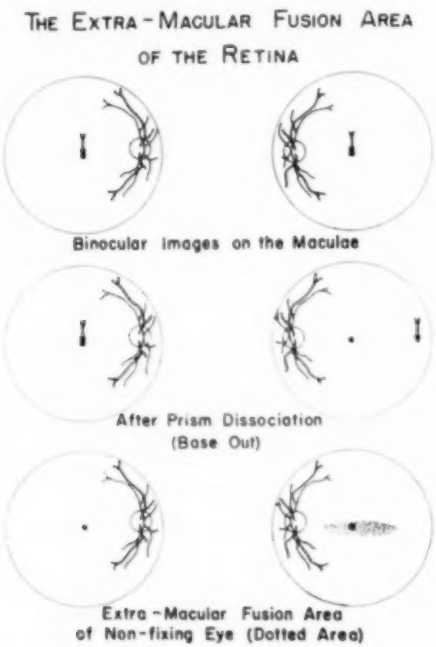

Fig. 3 (Tait). Extramacular fusion area of the retina.

With prism divergence, the extramacular fusion area is apparently smaller. Twenty percent have regained fusion at 6^{Δ} to 8^{Δ}, 50 percent require the prism to be reduced to, at most, 4^{Δ} to 6^{Δ}, and the remaining 30 percent require the prism to be reduced to 2^{Δ} to 4^{Δ} to regain binocular fusion.

From the standpoint of the stimulus-response mechanism in fusional vergence, the data suggest that in the amplitude determinations, the response of the extraocular muscles is dependent primarily upon the stimulation of receptors which immediately encircle the macular area. If, for example, in distance fixation, one eye tends to deviate from the object of regard as the result of the presence of an underlying tonic convergence abnormality for that fixation, these perimacular receptors are stimulated by the image edging over from the macular area and, as a consequence of a probably quite complex associative linking, the tonus of the extraocular muscles is modified and the macula is again brought under the image.

When this process has been carried as far as possible, however, which, from the physiologic standpoint, probably represents the point at which no additional receptors are available, fusion is broken and the eye quickly moves back to somewhere near the primary position, and diplopia is produced. In this situation, the subject fixes the stimulus object with the macula of one eye and, in the other eye, the retinal image is in one of the peripheral fields.

As the prism power is gradually reduced, the image in the periphery approaches closer and closer to the macula in its eye until it finally reaches a point in the peripheral retina where the number of sensitized receptors is great enough, or where there is a synaptical connection effective enough, to actuate the fusional vergence reflex, with the result that the tonus of the extraocular muscles is immediately modified, the eye shifted for macular perception and single binocular vision regained. Thus it becomes possible to plot in a given individual the area on each retina within which images must fall, if there is to be single binocular vision. I have termed this area the "extramacular fusion area." It is shown graphically in Figure 3.

Disregarding the intermediate centers and tracts concerned in these reflexes, which can safely be done in an investigation with an objective such as the present study, we may

consider the perimacular and extramacular receptors and the ocular movements which result from their excitation, as the essential part of the stimulus-response mechanism which is charged with the maintenance of single binocular vision.

As far as the retinal receptors are concerned, it is uncertain whether those concerned in the fusional vergence reflex are rods or cones, or both, and for the present purpose it is immaterial, although the greater number in the perimacular area, as compared to the lesser number in the periphery, and the fact that the process is intimately connected with central vision, would suggest that the receptors are probably cones.

Although not presented in this study, the supra- and infravergence and reversions to fusion may also be obtained and the perimacular and extramacular fusion-area values determined in a vertical direction.

The practical clinical use of the procedures and data presented is beginning to be appreciated by those who are concerned with the abnormalities of binocular vision. The study of presumably normal individuals, at least those with apparent ocular efficiency and comfort, is necessary, in order to provide a precise knowledge of the range of normal variation. With a knowledge of the normal distribution and characteristics, the abnormal cases can then be studied, the faulty stimulus-response systems determined, and an intelligent attack planned to correct the difficulty.

The direct application of the stimulus-response mechanism, as discussed in this paper, to faulty binocular balance situations can be illustrated by the employment of the use-amplitude fraction. The fusional vergence function has, as its chief duty, the securing of single binocular vision and fusion in cases where the individual does not happen to be orthophoric for the fixation distance.

If he is other than orthophoric for this given fixation distance, the binocular images are held upon the two maculas only by the repeated and frequent stimulation of the perimacular fusional receptors, already discussed. If the need of such compensation is determined by a measurement of the heterophoria at the fixation point, the efficiency of the perimacular receptors in providing for its constant neutralization can be obtained by measuring the fusional vergence at that same point and in the proper direction.

For example, if the patient has 4^{Δ} of exophoria relative to his fixation at 6 meters, he has constant repeated stimulation of his temporal perimacular receptors on either or both maculas. If he has a sufficient number of receptors, and if they have well-completed synaptical reflex connections with the distribution of motor innervation to the extraocular muscles, the exophoria can be well compensated for and the individual will be comfortable.

If, on the other hand, the efficiency of the temporal perimacular receptors and their reflex pathways is not great enough, discomfort from the convergence effort will ensue. As yet unpublished studies in this connection suggest that the average individual may use from one quarter to one third of his total amplitude of prism vergence in the required direction without particular discomfort. If this amount is exceeded, there is a possibility, or a probability, of discomfort from the convergence situation.

In the case discussed above, let us assume that the prism convergence has been tested and found to be 2^{Δ}. In such a case, therefore, the fusional convergence required for the constant correction of the exophoria for distance would be 4^{Δ}, that is, the temporal perimacular receptors would have to be stimulated to that extent constantly. In addition to this, they can overcome 2^{Δ} prism base-out before diplopia occurs. Thus the amplitude of the positive fusional convergence would be the amount constantly used, 4^{Δ}, plus the 2^{Δ} of prism convergence, or a total of 6^{Δ}. Of this 6^{Δ}, 4^{Δ} would have to be used constantly, the use-amplitude fraction would

be 4/6, or considerably more than the one quarter to one third amount which could be used without distress.

The corrective process in such a case then would suggest one of two approaches: first, that an effort be made to lessen the exophoria for distance; or, second, to increase the amplitude of fusional convergence to the point where it could take care of the situation without stress. The third possibility, that of neutralizing the exophoria with a prism base-in, has not been considered, as experience through the years has shown that, in the long run, it would be apt to make the condition worse.

In such cases as that cited, attempts to modify the tonic convergence innervational distribution are generally unproductive, leaving, as the only other feasible alternative, a deliberate effort, by exercise of suitable type, to increase the amount of the positive fusional convergence amplitude.

All binocular balance deficiencies can be diagnosed in terms of the particular stimulus-response mechanisms which are at fault, and diagnosis in terms of these reflexes will permit an intelligent prescription of exercise or other corrective procedure designed to discourage or reinforce the appropriate reflexes.

Summary

The data on prism-convergence and prism-divergence trials in 500 adult clinical subjects has been presented.

These data have been interpreted in terms of the source of the stimuli for the motor responses noted. The function of the perimacular fusional receptors, those immediately surrounding each macula, and the extramacular fusional receptors, those further in the periphery, have been discussed. The data suggests that the function of the perimacular group is to retain fusion when once established, while the function of the extramacular group is to aid in establishing or gaining fusion.

The development of the use-amplitude fraction and its application in the diagnosis of binocular dysfunction is presented.

1321 West Main Street.

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SURGICAL REPAIR OF NEUROFIBROMATOSIS OF EYELID*

MAX M. KULVIN, M.D.
Hines, Illinois

In the *Virginia Medical Monthly* of November, 1941, and in the second edition of his textbook (1941) Spaeth writes, "Although much has been written about plexiform neuromata from a pathological and histological standpoint, the clinical correction of these cases has been neglected in the literature to an astonishing degree. This may be due to the various anatomical defects present, requiring quite a series of cases before any surgical procedures could be outlined."

After a short discussion of the characteristics of these tumors, Spaeth discusses the treatment he has evolved:

1. Roentgen therapy is of no value.
2. General anesthesia is necessary.
3. Dissection of the tissue, removal of all neoplasm, prevention of unnecessary scarring, and conservation of as much skin, tarsal plate, and hair line as possible is advised. Tissue extending into the orbit should be removed.
4. The skin, when removed, is replaced by a pedicle or sliding flap.
5. Cartilage grafts are frequently necessary as well.
6. Best results are obtained in those cases in which the various surgical procedures have been done with a fair interval of time intervening between each operation. From 2 to 4 years are usually necessary to obtain the best results.

When, in April, 1940, this type of case was seen for the first time at the Veterans Administration Hospital, Hines, Illinois, a search of the various available texts disclosed nothing but generalities in regard to the treatment. I can, therefore, concur with the statement of Spaeth which appeared the following year. It became necessary to evolve, out of a combination of various operative procedures, something to fit this particular type of disability without attempting a complete removal of the lid. Inasmuch as there was hardly one centimeter of tissue which did not contain numerous tumors, it was not felt desirable to transplant such skin in the form of a flap, since we were not familiar with the reaction of such tissues.

General anesthesia was not considered necessary and was not used. Although our first case required no cartilage graft, the second one did, in a sliding-flap formation.

Each case required a number of operative procedures. The removal of various masses from the temporal region and eyeball necessitated a pause to allow for observation and reëvaluation of the result up to that time. The first case was almost completed in one step, but several small subsequent procedures were necessary before a satisfactory result was obtained.

Eight years later, the second case was carried out in more prudent fashion requiring about six procedures before completion.

ORIGIN AND PATHOLOGY

While it is not the purpose of this paper to discuss the origin and pathology of this disease, a short résumé of the essential features might be of interest. Von Recklinghausen's disease is considered to fall in the group of diseases resulting from developmental abnormalities of the ectoderm and mesoderm. It is a congenital condition, sometimes inherited and sometimes encountered as a familial disease. It is characterized by tumors of the skin, cutaneous pigmentation, multiple tumors arising from the sheaths of cranial, spinal, peripheral, and sympathetic nerves, abnormalities in bones, defective de-

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velopment of the central nervous system, other developmental abnormalities, and buphthalmos.

Unger finds that this tumor may appear wherever there are nerves. In the skin, it may appear as tumors, or pigmentation in form of café-au-lait spots; in the iris, as brownish pigmented tumors; in the choroid, as a "string of pearls;" and as a plexiform neuroma in the region of the eyes, ears, forehead, and neck. The tumors occur along the vagus, acoustic, trigeminus, and sympathetic nerves.

Penfield and Young state that these tumors are invariably made up of tissue of tangled or reticular structure, described by Antoni as Type B, and sometimes contain areas of true perineural fibroblastoma, described by Antoni as Type A. The tangled areas are evidence of a connective-tissue reaction to that obscure abnormality characteristic of nerve fibers in this disease. They find three types of tissue involved—nerve trunk, meninges, and central-nervous system.

The tangled or reticular tissue constituting the background of all neurofibromas should be considered a connective-tissue and sheath-of-Schwann reaction about the fibers of the nerves. Antoni called this Type B—in which no palisading of nuclei or polarization of cells was present. Type A possesses both characteristics—there is an orderly appearance of long slender fibers with silver staining properties, a palisading of the nuclei produced by an orderly parallel arrangement of the cell nuclei, which are elongated with blunt ends. Some areas resemble the structure of the Wagner-Meissner tactile corpuscles.

The Type-B cells are haphazardly arranged and mucocystic degeneration may be present. The fibers are of the reticular type. Collagen bands are rare—Antoni believes that the Type-B cell represents a degenerative phenomenon, a jellification of Type A.

Throughout the three tissues in which neoplasm appears, there is definite evidence of a hyperplastic reaction of the cells peculiar to those tissues. This indicates, says Penfield, that in von Recklinghausen's disease an irritant or stimulating influence is exerted on various tissues causing hyperplasia. Superimposed on, or subsequent to this effect, is the appearance of neoplastic growth of these cells.

Recent work on the production of tumors by Oertel and Ricker suggests that previous to neoplastic growth of cells there is a stage in which, owing to some neurovascular stimulus, the cells that are destined to become neoplastic undergo a hyperplastic change. A chronic irritant is capable of initiating tumor growth. It may be that the congenital defect in the nervous system is capable of producing the necessary irritation of adjacent tissues, producing hyperplasia and later neoplastic growth.

In none of the tumors can the type cell be said to be embryologically undeveloped. The tumors produced preserve the peculiar characteristics of the connective tissue in question. This speaks in favor of the production of tumors by an irritative process rather than from some embryologic rest.

Case reports

Case 1

The first patient, R. C. F., a man, aged 50 years, was admitted to Hines Hospital on April 1, 1940, and discharged on August 5, 1940.

Personal history. He had had the usual childhood diseases. He stated that he was born with a drooping eyelid and that he also had a growth behind the left eye which was discovered when he was eight years old. Nine operations for this growth were performed between 1902 and 1908. From the time he was 15 years old, his eyelid has drooped entirely over the eye and thickened blebs have been there ever since. At birth, he had some nipplelike cysts on various parts of the body and many brown spots all over the body. In 1920 he began to develop wartlike bumps of various sizes over his entire body. The biggest one was the size of a

walnut; the smallest, the size of a match head. The skin was dotted with smaller bumps, like prickly-pear spots. The large ones hurt if pressed, but not otherwise. Generally he felt well.

Physical examination revealed a fairly well-developed, well-nourished white ambulant man who did not appear acutely ill. His

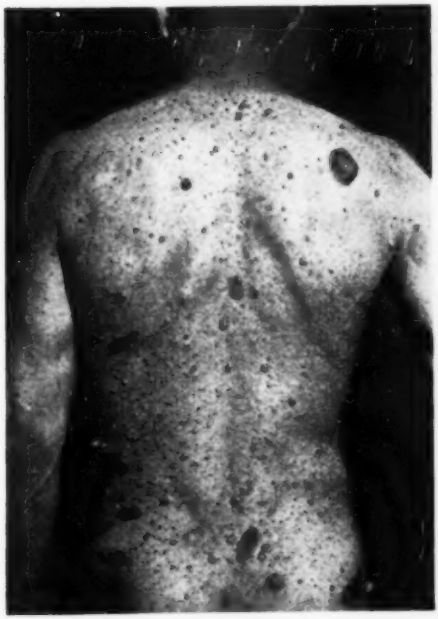

Fig. 1 (Kulvin). *Case 1.* Tumors of the skin and café-au-lait pigmentation.

height was 5 feet 6½ inches; weight 133 pounds. His head was normal in size, but there were many nodules on scalp. A fairly large-sized nodule was present in the mucosa of the left cheek. There were countless nodules all over the body, ranging in size from a few millimeters to as large as a walnut (fig. 1). Hearing tests showed he could hear a conversational voice at 35 feet.

Neurologic examination revealed anesthesia and atrophy of the right leg.

Eye examination. The right eye was negative. The left lid was completely ptotic and was large, pendulous, and thickened, especially at lid margin. A soft fatlike thickness in a roll-like formation extended from the lateral border of the lid over the zygomatic area. Distended vessels were noted in the skin of the upper lid (fig. 2).

With conspicuous effort, the lid could be elevated, revealing slight conjunctival injection. The fundus was normal. A large con-

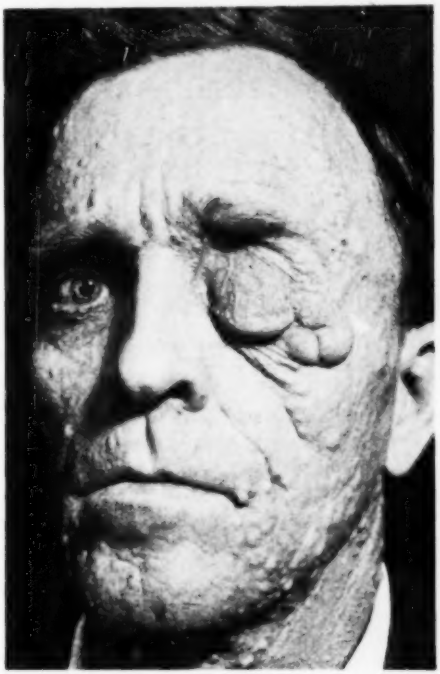

Fig. 2 (Kulvin). *Case 1.* Neurofibromatosis of the eyelid before plastic correction (May, 1940).

junctival mass was present on the sclera of left eyeball.

Vision was: R.E., 20/20; L.E., 20/100, correctible to 20/50. The pupils reacted to light and accommodation; the left pupil was smaller than the right.

Diagnosis. Generalized von Recklinghausen's disease, including left eyelid and eyeball. Plastic correction of left upper lid was recommended.

Operative procedure. The procedure carried out followed no recognized pattern, but

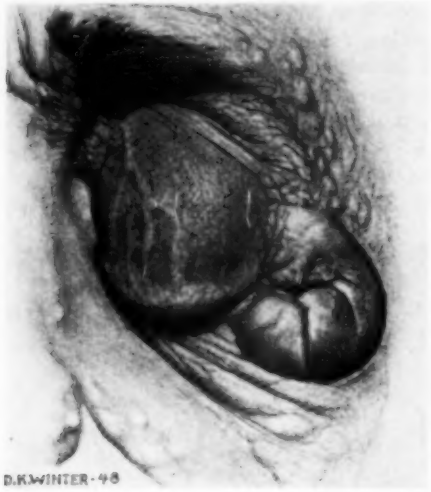

Fig. 3-1 (Kulvin). *Essential steps in the surgical repair of the lid in Case 1 (figs. 3-1 to 3-6).* The large lipomatous mass in the zygomatic region was removed. The skin was undermined and drawn together and sutured.

was a combination of Hunt-Tansley method with some necessary modifications being added as we continued.

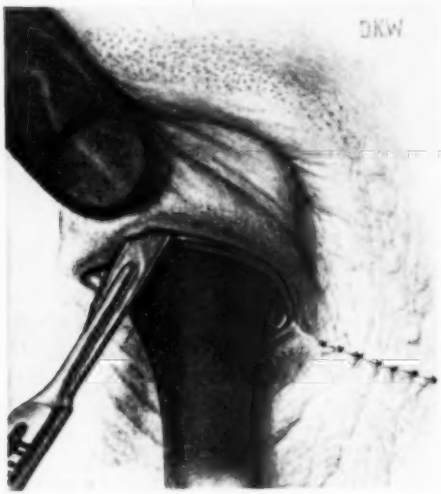

Fig. 3-2 (Kulvin). The upper lid was split, separating the tarsus and mucous membrane from the orbicularis and skin.

First, the large lipomatous mass in the zygomatic region was removed and the skin was undermined and drawn together and sutured (fig. 3-1).

The upper lid was split in the gray line (which was markedly thickened) across its entire length, separating the tarsus and mucous membrane from the orbicularis and skin (fig 3-2). The inner section of the lid was seen to be markedly enlarged and thickened. The thickened mass of tissue lying intermedially was removed as completely as possible. A wedge-shaped piece of tarsus and membrane was mapped out and removed (fig. 3-3) and the edges were approximated with silk beginning up near the fornix and going down to the lid margin (fig. 3-4). After the repair of the inner section, a large redundant skin surface was seen to be

Fig. 3-3 (Kulvin). A wedge-shaped piece of tarsus and membrane was mapped out and removed.

present. A plastic correction of the outer lid surface was now carried out.

An incision was made 3 mm. above the lid margin, extending from each canthus to the midline and leaving a strip of tissue, 4 mm.

wide, between the incisions. The incisions were carried up to the orbital margin just below the hairline perpendicular to each other, and the incision lines were joined (fig. 3-5).

A curved incision joined the outer ex-

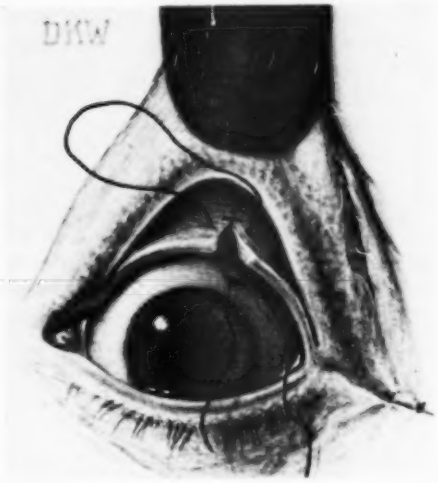

Fig. 3-4 (Kulvin). The edges were approximated with silk beginning up near the fornix and going down to the lid margin.

tremity of the incision at the lid margin with the perpendicular incision, making a triangular flap of skin which was removed. The ribbon of skin was dissected down to the lid margin. A double-armed silk suture was carried through the upper end of the ribbon strip. The cut edges were united with silk sutures. A stab incision was made 3 mm. above the eyebrow and tunnelled beneath the eyebrow down to the upper edge of the strip. The ribbon was drawn up by the sutures through the incision in the forehead, cut off flush with the skin, and fastened there by several silk sutures. The incision at the gray line was closed by interrupted silk sutures (fig. 3-6). Hot saline gauze dressings were applied because the skin appeared discolored—rubber drains were inserted for the purpose of continuous saline drip—oil

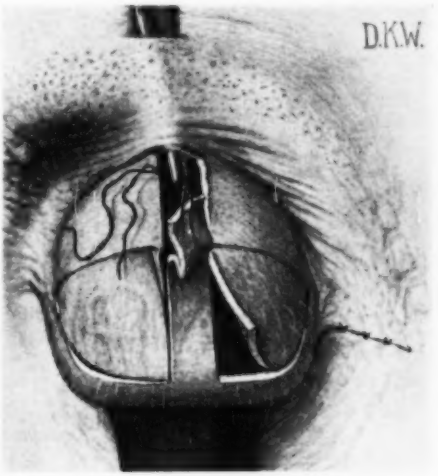

Fig. 3-5 (Kulvin). The incisions were carried up to the orbital margin just below the hairline, perpendicular to each other, and the incisions were joined.

silk covering was applied over this and the eye bandaged. Sloughing of the epithelium took place, with regeneration by granulation and scar formation. On August 5, 1940, the patient was discharged with the advice that further surgery was needed (fig. 4).

Pathologic report. The pathologic specimen was described by Dr. Robert Schreck,

Fig. 3-6 (Kulvin). Placement of the sutures.

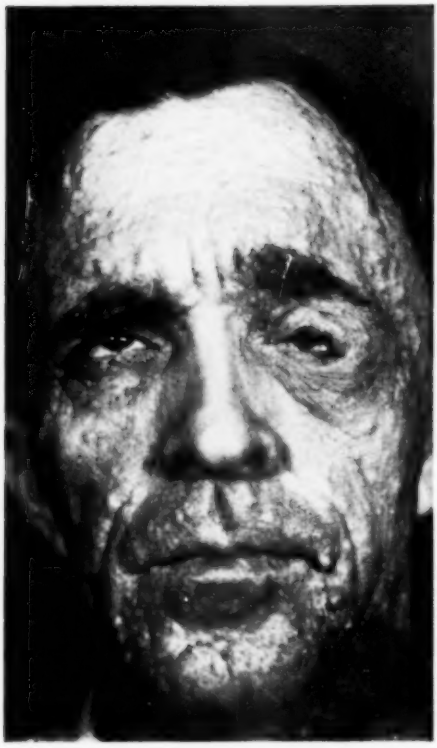

Fig. 4 (Kulvin). *Case 1.* Postoperative appearance.

as consisting of normal epidermis, beneath which were numerous, irregularly distributed, small fibroblasts with a small number of intercellular collagenous fibers. The nuclei of the fibroblasts were elongated, small, and stained lightly. There was no inflammatory exudate. The fibroblasts surrounded and infiltrated the normal glands of the corium and subcutaneous tissue. The pathologic diagnosis was neurofibroma (figs. 5 and 6).

Second operation. The patient was readmitted on October 21, 1940, for removal of a tumor mass involving the left sclera and extending onto the cornea, well shown in Figure 7.

On October 29, 1940, the operation was intended to be an enucleation but, after incising the conjunctiva and laying it back, the mass was found to be easily shelled away from its scleral bed and removed. No infiltration of the sclera was found. The blood supply to this mass from the inferior pole of the eyeball was marked.

The specimen as described by Dr. Robert Schreck consisted of a bundle of young fibroblasts having small elongated leptochromatic nuclei. A moderate amount of interstitial collagen fibers was present. In a few spaces there was a tendency to palisad-

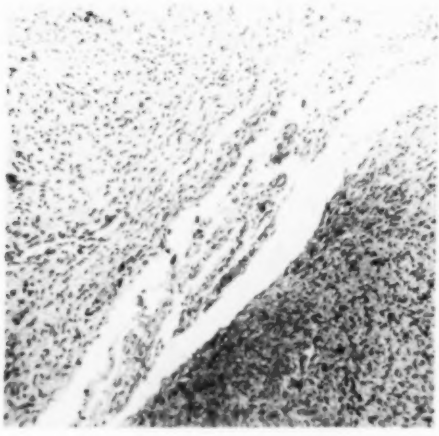

Fig. 5 (Kulvin). Low-power view of section showing irregularly distributed small fibroblasts, small amount of intercellular collagen fibers, and elongated nuclei.

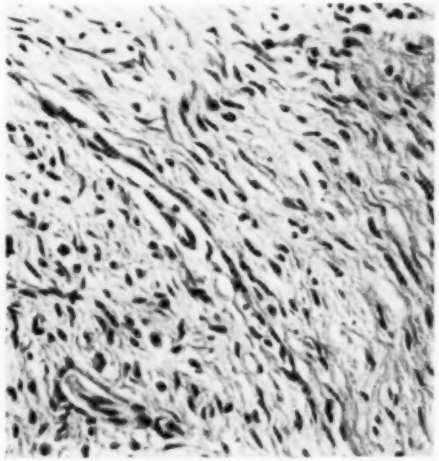

Fig. 6 (Kulvin). High-power view of section showing lightly stained, elongated nuclei of fibroblasts.

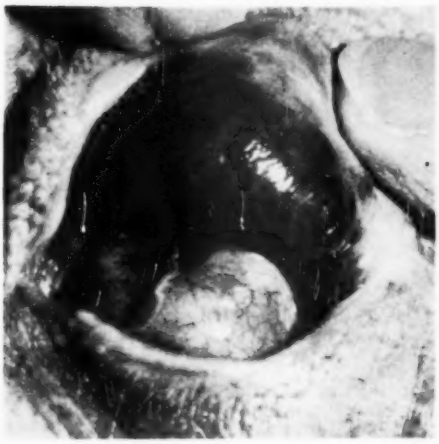

Fig. 7 (Kulvin). *Case 1.* Tumor of the eyeball (May, 1940).

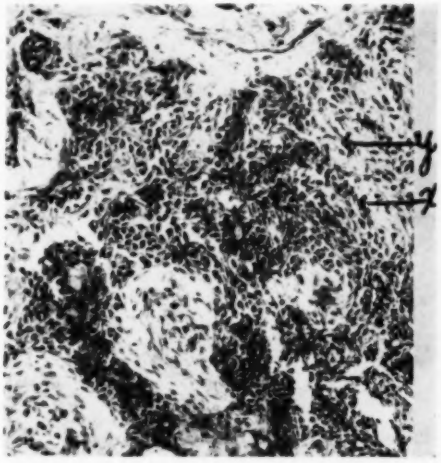

Fig. 8 (Kulvin). Low-power view of section showing (x) palisading of nuclei and (y) moderate amount of interstitial collagen fibers.

ing of the nuclei. The capillaries were quite numerous and lined by young epithelial cells. The tissue was infiltrated with a moderate number of lymphocytes and plasma cells. The diagnosis was neurofibroma with chronic inflammation (figs. 8 and 9).

After a period of convalescence, the mass on the left buccal surface, which to all intents and purposes was also a neurofibroma, was removed (fig. 10).

Microscopic examination revealed a small papillary nodule, with many small and large acini, lined by flattened and cuboidal epithelial cells with uniform nuclei. The

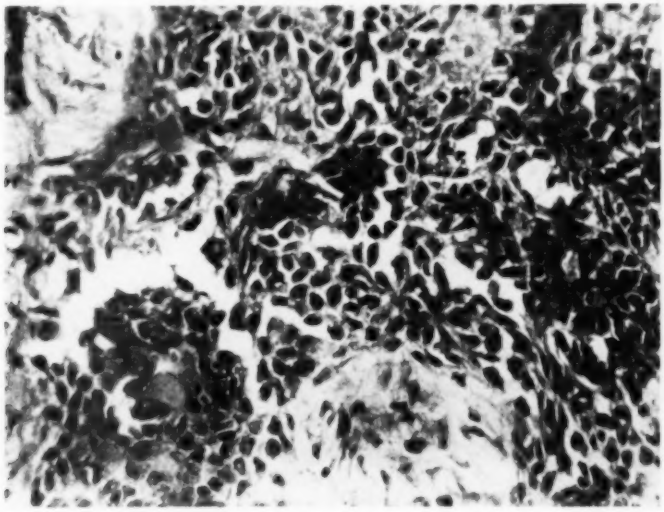

Fig. 9 (Kulvin). High-power view of section showing fibroblasts with palisading of nuclei.

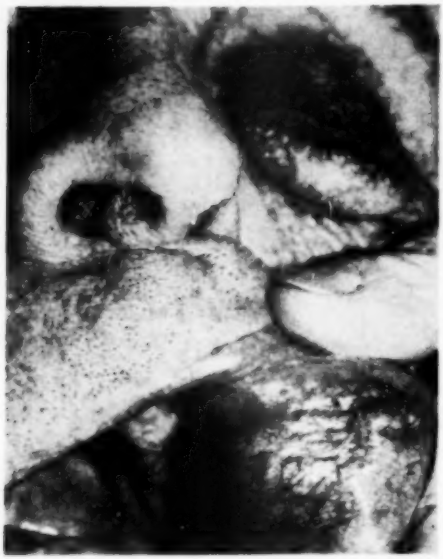

Fig. 10 (Kulvin). Buccal mucosa tumor.

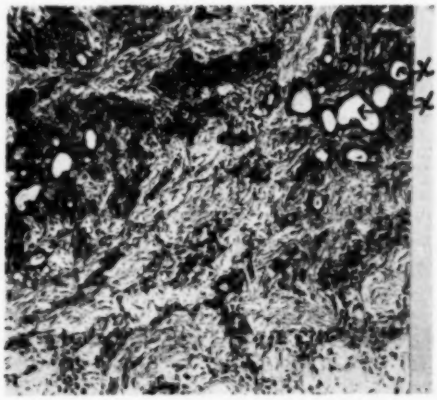

Fig. 11 (Kulvin). Low-power view of section showing (x) many large and small acini. The stroma consists of dense fibrous tissue and a small amount of myxomatous tissue.

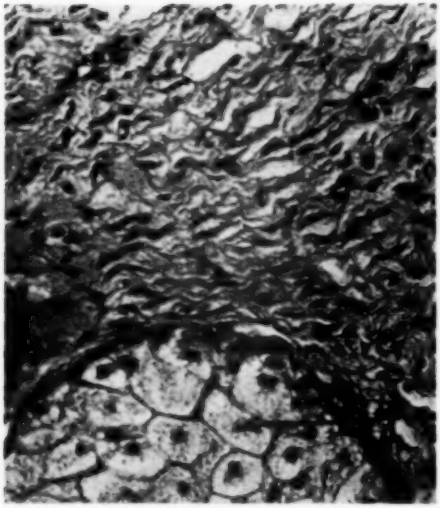

Fig. 12 (Kulvin). High-power view of section showing (y) large mucous gland attached to nodule.

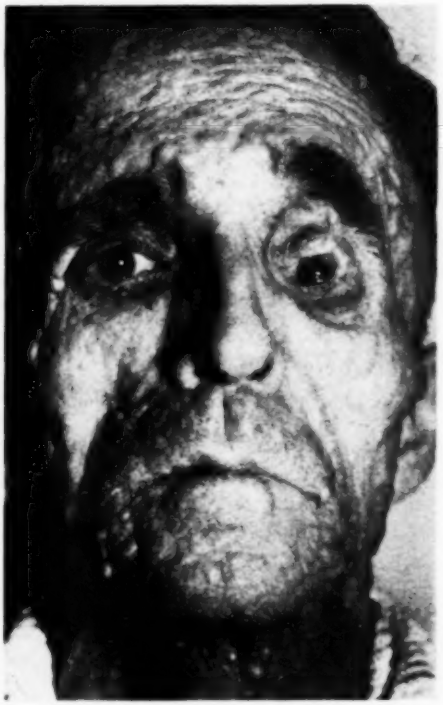

Fig. 13 (Kulvin). *Case 1.* Postoperative appearance on October 8, 1945.

stroma consisted of a moderate amount of dense fibrous tissue and a small amount of myxomatous tissue. The capsule of the nodule was thick. Attached to the nodule was a large mucous gland. The diagnosis was mixed tumor of the salivary gland (figs. 11 and 12). Of course this finding, when a neurofibroma was expected, was quite surprising.

A secondary plastic procedure was done. Some redundant tissue on the globe was removed, synechias were severed, and the ectropion which had developed was repaired. He was discharged on December 23, 1940.

Outcome. The patient was re-admitted on August 6, 1945, for a possible retroperitoneal tumor, possibly fibrosarcoma. On operation, a biopsy was taken which revealed fibrosarcoma. Nothing further was done. His lid showed no recurrence of the tumor and cosmetically was satisfactory (fig. 13).

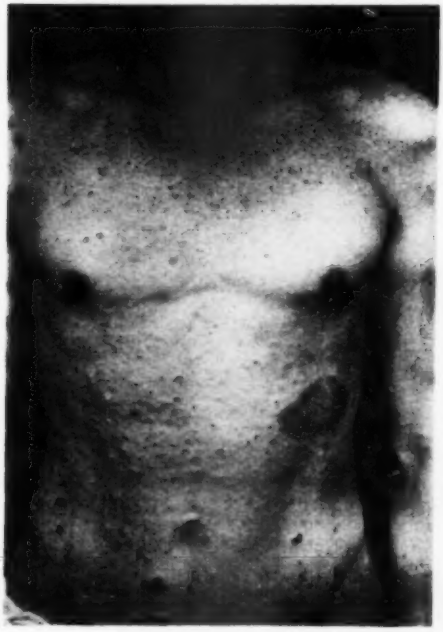

Fig. 14 (Kulvin). *Case 2.* Tumors of the skin and café-au-lait pigmentation.

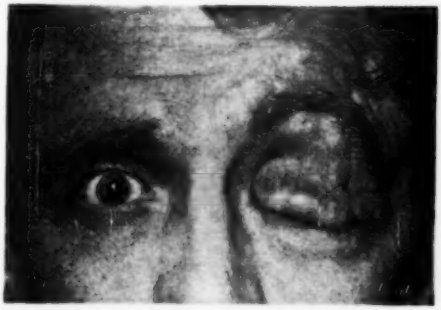

Fig. 15 (Kulvin). *Case 2.* Neurofibromatosis of the left eye before correction (June 18, 1947).

Case 2

The second case, seen June 9, 1947, presented a somewhat different problem. The patient, B. C. H., a man, aged 30 years, was admitted on that day to Hines Hospital complaining of drooping of the left eyelid for 22 years. He stated that the drooping lid became completely ptosed after a lid operation in 1937. He had had three operations on the upper lid of the left eye between 1937 and 1946 by a private physician. His past general history was negative except for hemorrhoidectomy in September, 1945.

Physical examination on admission showed numerous soft papular elevations of the skin over his abdomen, neck, and chest (fig. 14).

Eye examination. Vision was: R.E., 20/20; L.E., 20/200, correctible with pinhole to 20/40−2.

Right eye. The anterior segment, media, fundus, tactile tension, and ocular movements were normal.

Left eye. Anterior segment, media, and fundus were normal. The left upper lid was markedly thickened and indurated. The lid margin was three times its normal thickness. No tarsal plate could be felt. The lid was completely ptosed and could not be raised except slightly in the nasal angle by an exceptional effort of the frontalis muscle.

The conjunctival surface of the left upper lid had multiple scars adherent to the under-

lying tissue. Fine bands of connective tissue ran between the bulbar and palpebral tissue in the upper and outer quadrant of the eyeball. There was a marked soft swelling over the loose skin of the left temple extending to the outer canthus of the left eye. The bone underneath the swelling seemed slightly irregular and the temporal fossa seemed deeper on the left side (fig. 15).

Laboratory. X-ray studies of the left orbit and left temporal fossa failed to reveal any evidence of significant bone abnormalities.

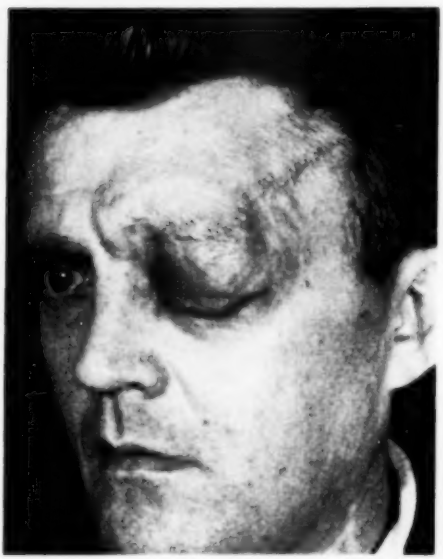

Fig. 16 (Kulvin). *Case 2.* Postoperative appearance on July 17, 1947, after first surgical procedure and removal of plexiform neuroma from temporal region.

Urinalysis, complete blood count, complement-fixation and Wassermann tests, bleeding and coagulation time were all negative.

Course in hospital. A tumor mass of the left upper lid and left temporal region was removed June 28, 1947 (fig. 16). The pathologist, Dr. W. W. McNamara, described new growth made up of spindle cells, forming interlacing bundles and palisading, imitating nerve sheath. The growth was quite cellular but with moderate amount of intercellular collagen in some areas. Cells grew diffusely resembling the so-called Antoni type of neurogenic tumor. There was no capsule. The diagnosis was neurofibroma (figs. 17 and 18).

Fig. 17 (Kulvin). Low-power view of section showing spindle-cell growth, interlacing bundles, and palisading. Diffuse cell growth resembles so-called Antoni-type tumor.

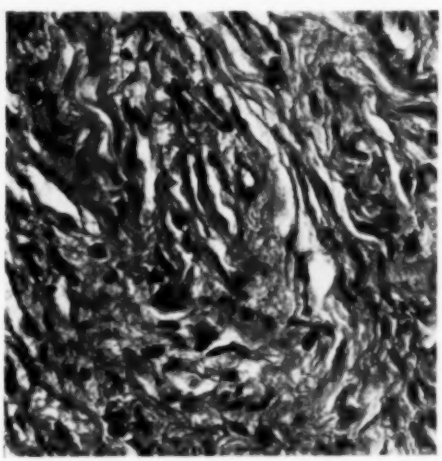

Fig. 18 (Kulvin). High-power view of same section shown in Figure 17.

On July 23, 1947, a moderate-sized mass

was removed from the left upper lid. The sections showed spindle cells growing in whorls, fairly well vascularized. The diagnosis was neurofibroma (figs. 19 and 20).

These procedures were all preliminary to

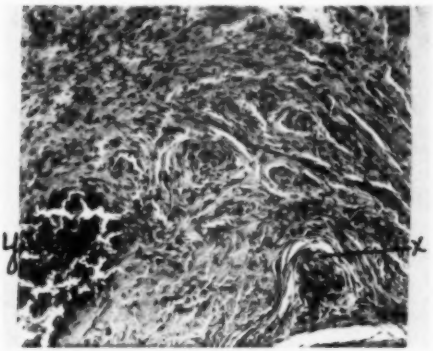

Fig. 19 (Kulvin). Low-power section showing (x) spindle cells growing in whorls and (y) vascular section.

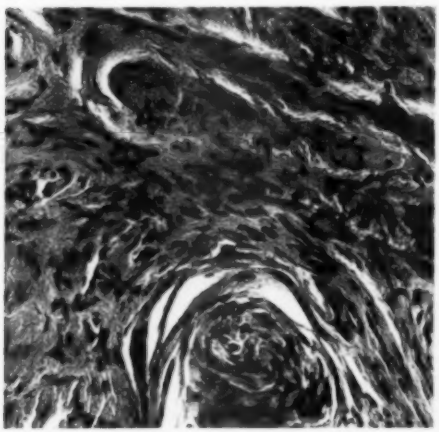

Fig. 20 (Kulvin). High-power view of same section shown in Figure 19.

the next step which consisted of the formation of a new tarsal plate for the upper lid. This was carried out by Dr. H. B. Field in a plastic reconstruction of the left upper lid.

Operation. A lid spatula was introduced under the upper lid. An incision was made

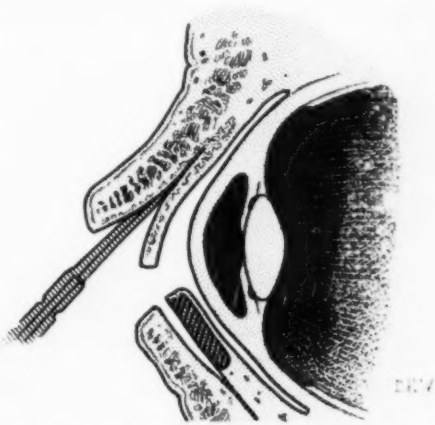

Fig. 21-1 (Kulvin). *Essential steps in the surgical repair of the upper l'd in Case 2 (figs. 21-1 to 21-5).* An incision was made at the white line of the lid margin from the outer to the inner canthus.

at the lid margin, from the inner to the outer canthus, separating the conjunctiva from the remnants of tarsal plate and skin. The incision was extended, by blunt and sharp dissection and up into the region of the lid fold,

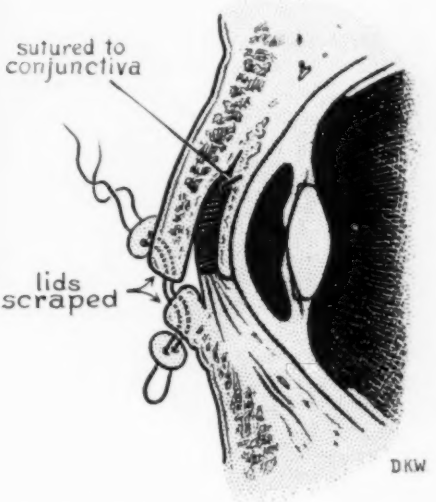

Fig. 21-2 (Kulvin). A sliding flap was slid into position across the palpebral fissure and anchored to the conjunctiva.

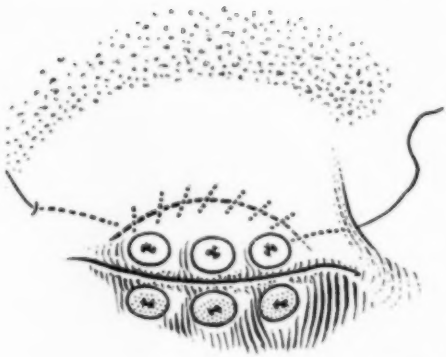

Fig. 21-3 (Kulvin). Tarsal plate was sutured to the conjunctiva.

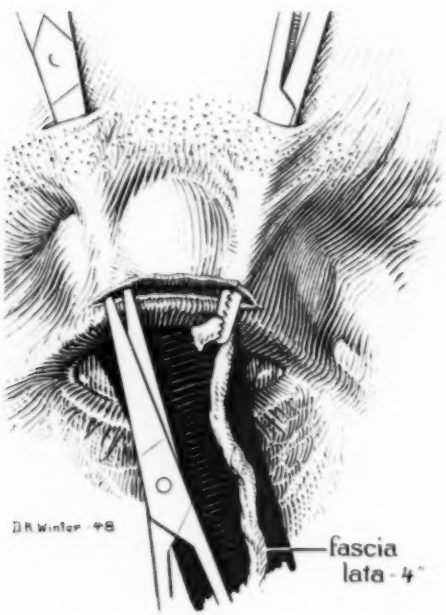

Fig. 21-4 (Kulvin). Repair of ptosis was carried out by the introduction of a fascia-lata sling.

to the point which would be approximately 2 cm. from the lid margin. A similar maneuver was accomplished in the lower lid, and an incision was made at the white line of the lid margin from the outer to the inner canthus (fig. 21-1).

The conjunctiva and tarsal plate were separated from the lid through this incision but were left at their attachment inferiorly. This comprised a sliding flap which was slid into position across the palpebral fissure and anchored to the conjunctiva of the superior lid at its inferior portion (fig. 21-2).

A continuous No. 1, black silk suture was introduced 1 cm. temporally to the lateral canthus, and this was brought into the tarsal

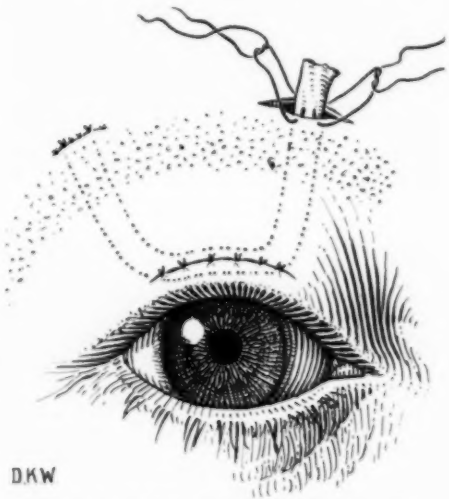

Fig. 21-5 (Kulvin). Suturing after placement of fascia-lata sling.

flap from the lower lid, comprising a running suture between the tarsal plate of the lower lid and conjunctival flap of the upper lid. This suture was carried the entire extent of the flap and emerged 1 cm. nasally to the nasal canthus and on the side of the nose.

The lid margins were then approximated by means of three marginal notchings of the skin proper and mattress sutures were placed from the inferior lid to the superior lid, tightly binding these exposed notchings together, so that complete union of the skin part of the lids was established at these three points. Drains were inserted at both

lateral and internal canthi. A plastic silk dressing with pressure bandage was placed over this eye (fig. 21-3).

The pathologic examination showed the specimen to be similar to the neurofibromas previously described.

After two months' convalescence the tarsorrhaphy was opened, a slight repair of the lower lid was accomplished and the symblepharon present was released on November 19th.

The completion of the repair of the ptosis was carried out on November 26th with the introduction of a fascia-lata sling by Dr. H. B. Field.

Stage 1. A strip of fascia lata, 4 inches long, was excised from the left thigh.

Stage 2. An incision was made parallel to the upper lid margin of the left eye, 5 mm. from the lash line. A cataract knife was introduced and inserted up through the upper lid extending up to the upper edge of the brow. Two tunnels were prepared (fig. 21-4). The strips of fascia lata were inserted through the tunnels forming a suspension of the lid from the incision just above the lid margin. Both ends of the fascia lata were sutured to the periosteum in the brow region. The skin incisions were closed with black silk. A Buller shield with vaseline was used as an eye dressing (fig. 21-5).

Since some excess fibromatous tissue remained, this was removed January 12, 1948, and the defect was repaired by Dr. James E. Lebensohn. Some redundant bulbar conjunctiva and thickened mucosa were reduced with Ziegler cautery. A repeat cautery was required on February 1, 1948, for the persistent ectropion—this practically disappeared after the punctures. The palpebral

Fig. 22 (Kulvin). *Case 2.* Appearance of patient after completion of surgical procedures.

conjunctiva was greatly thickened and arranged in vertical folds. The lower lid showed a thickened conjunctiva arranged in papillary form (fig. 22).

Manifest refraction showed: R.E., 20/15; L.E., 20/50. There was an esophoria of three diopters for distance and near—and a right hyperphoria of two diopters.

Conclusions

In conclusion, we are aware that the eye results obtained were not artistically perfect. Unquestionably a cosmetic improvement was obtained, in comparison with the situation as it existed for so many years. In the second case, a readjustment of the fascial sling might be undertaken if no further contraction occurs. It must be remembered, however, that the many previous operative interferences certainly added to the difficulties to be overcome.

Veterans Administration Hospital.

Acknowledgement is hereby given to Dr. M. I. Edelman for assistance in the first case and to Mr. Ralph Creer for the photographs; in the second case to Dr. David S. Koransky, Dr. Sidney G. Stern, and Dr. David S. Kane, to Mr. Peder Lund for the photographs, and to Mr. D. K. Winter, medical illustrator, for the excellence of the drawings.

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Ophthalmic Miniature

Here is the formula useful in both chalazion and styes. Take frankincense and myrrh, of each, one dram; gum labdanum, alum, Armenian saltpeter, of each one-fourth dram. Mix thoroughly with a sufficiency of lilies and old olive oil, and apply the mixture. If these remedies fail, the lid and tumor must be deeply incised with a round-headed lancet and the chalazion scraped out with a spoon at the end of the sound. When the operative wound is large and deep and the parts flaccid, the lips of the wound should be drawn together in the middle by a suture, after which dust on some yellow powder. When the tumor is on the inner surface of the lid, the latter should be everted and the tumor removed from its inner surface. Then order the eye to be irrigated with warm water.

Memorandum Book of a Tenth-Century Oculist

Translated by Casey A. Wood.

A SURVEY OF ANTERIOR SEGMENT PHOTOGRAPHY

EDWIN S. WRIGHT, M.D.
Los Angeles, California

At the present there are a number of methods in use for photographing the anterior segment of the eye. In the hands of its proponent each method is undoubtedly capable of producing good photographs. Many are called "simple methods" and some, perhaps, are. But, in general, the enthusiastic clinical photographer has a much greater technical knowledge of photography than the average ophthalmologist and not all methods advocated are equally easy to use. It would, therefore, seem advantageous to review the several methods in general use and to evaluate them with respect to simplicity, economy, general adaptability, and availability. In order adequately to explore the possibilities of the methods and to understand better the problems involved, an elementary knowledge of photographic optics, filters, film, and lighting is desirable. Optics should present no problem to the ophthalmologist, since the same formulas with which he is already familiar are used in spectacles and geometric optics. The other items will be of interest also, since a knowledge of them will improve his photographic technique in general, and materially increase his enjoyment of this fascinating hobby.

A. PHOTOGRAPHIC OPTICS

The basic relationship of object, lens, and image is expressed in the simple formula

$$\frac{1}{F} = \frac{1}{u} + \frac{1}{v}$$

where F equals the focal length of the lens, u equals the object to lens distance, and v equals the lens to film distance.

For practical purposes, u and v are measured at the lens diaphragm, for good lenses are not simple, thin lenses but are combinations of various lens elements often having considerable length to the assembly. Their equivalent plane is usually at the diaphragm.

EXAMPLE

With a certain lens, the distance from lens to film is 6 inches when focused on an object 12 feet away. What is the focal length of the lens?

12 feet = 144 inches

$$\frac{1}{F} = \frac{1}{144} + \frac{1}{6}$$

F = 5.76 inches

The image size is expressed in the formula

$$R = \frac{\text{object size}}{\text{image size}} = \frac{u}{v}$$

where R is the reproduction ratio.

EXAMPLE

A camera is focused on an object 20 inches away. The lens extension is 5 inches. How much will the object be reduced on the film?

$$R = \frac{20}{5} = 4 \text{ times.}$$

If the object is 8 inches high, what will be the image size?

$$4 = \frac{8}{i}$$

Image size = 2 inches.

The power of a lens combination is expressed by

$$P = P_1 + P_2$$

where P_1 equals the power of the photographic lens and P_2 equals the power of the supplemental lens. The distance between the two may be disregarded due to the short distance between them and the relatively long focal lengths.

EXAMPLE

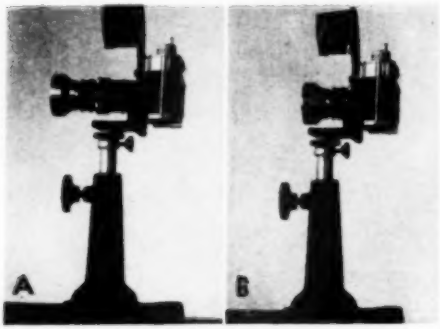
What is the power and focal length of a 50-mm. lens with a supplemental lens of 200-mm. focal length (plus 5 lens)?

$$P = \frac{1{,}000}{50} + \frac{1{,}000}{200} = +25 \text{ lens,}$$

or

$$\frac{1{,}000}{25} = 40 \text{ mm.}$$

The ratio of the focal length to the diameter of a lens determines its "f" number.



Figs. 1 A and B (Wright). Camera and copy attachment (A) with 35-mm. extension tube and (B) without extension tube.

The speed of a lens is inversely proportional to the square of the "f" number and the exposure required is directly proportional to the square of the "f" number. The amount of light received by the film is the product of the illumination and time of exposure; hence, if the lens speed is doubled, the exposure time is halved. Therefore, if the "f" stop is changed from f :4 to f :8, four times the exposure time must be used.

On the camera, each stop from higher to lower number doubles the amount of exposure of its predecessor. The actual amount of light passing through a lens is less than unity since each glass-air surface in the lens reflects back 5 percent of the light falling upon it. The number of glass-air surfaces in most lenses is 6 or 8, and exposure tables of lens manufacturers compensate for this. The "f" number marked is the proper one to use.

Stray light in lenses occurs from internal reflections at glass-air surfaces and may cause shadows to lighten the picture and cause poor contrast. Worse causes of poor contrast are fingerprints and dust on the lens. Coating of the lenses eliminates "ghosts," flare spots, and stray light. It increases the light transmission but its principal value lies in the fact that it improves contrast.

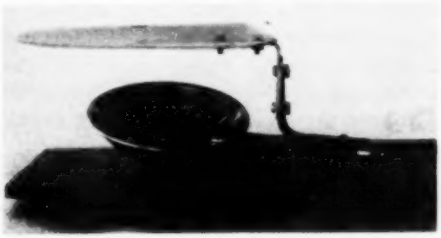


Fig. 1 C (Wright). Hand flashgun with bracket and two transparent X-ray films with tissue paper (diffuser) in between. This is to protect the patient if bulb shatters. Flashgun is shown resting on camera platform.

The speed of a lens varies with the bellows extension. Since the f number is accurate only when the lens is set for infinity, it is highly important to know the effective aperture when the lens is used for close up work. This is found by the formula

$$\text{Effective Aperture} = \frac{V}{F} \times f$$

where V = lens film distance
F = focal length of lens
f = marked lens aperture

EXAMPLE

A 4-inch lens is focused on an object 20 inches away. If the lens extension is 7 inches and the aperture is f8, what is the effective aperture?

$$EA = \frac{7}{4} \times 8 = f14$$

(To measure the lens extension, measure the amount it moves forward from the infinity mark and add it to the focal length.)

Fig. 2 A (Wright). Black and white copy of Kodachrome showing full face when using no extension tube.

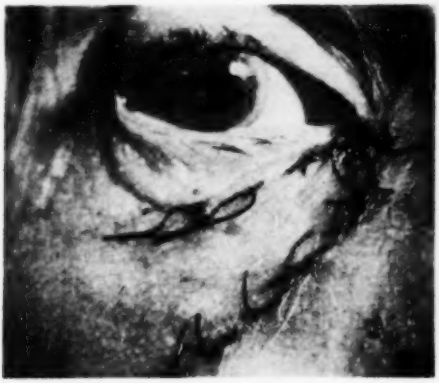


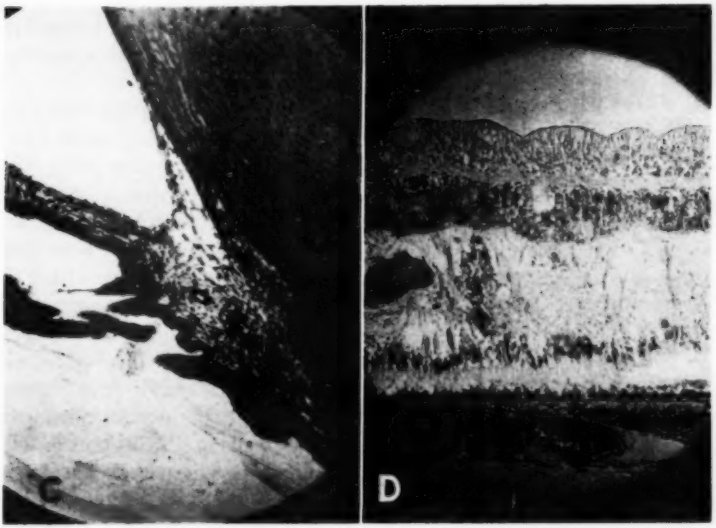
Fig. 2 B (Wright). Black and white copy of Kodachrome showing use of 11-mm. extension tube.

If a supplemental lens is used to bring near objects into focus instead of a lens extension, then the "f" number does not change *provided the lens is set for infinity*. The exposure correction can be computed directly from the formula

$$E = E_1 \times \frac{v^2}{f^2}$$

where E = correct exposure
E_1 = indicated exposure (by meter, and so forth)
v = lens film distance
f = focal length of lens

To avoid computations, the *Effective Lens Aperture Kodaguide* may be purchased for 10 cents and automatically performs them.



Figs. 2 C and D (Wright). Black and white copy of Kodachrome photomicrograph, using same apparatus as in 2 A and B. (C) Anterior synechia. (D) Diabetic retinopathy.

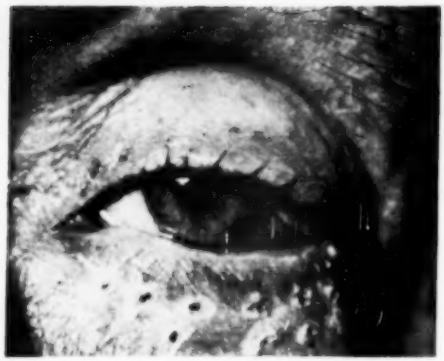


Fig. 3 (Wright). Ziegler cautery for entropion (from a color transparency).

Supplemental lenses are weak meniscus lenses which are used to focus the object closer and enlarge the image. A plus supplemental lens shortens the focal length; whereas, a minus lens lengthens it, and, therefore, requires a longer bellows extension. Both enlarge the image.

A supplemental lens attached to a camera focused at infinity will focus the camera on a plane whose distance from the camera is equal to the focal length of the supplemental lens used.

EXAMPLE

A plus 5D. lens will focus an infinity-set camera at 8 inches. Spectacle (meniscus) lenses obtained from the optician are quite satisfactory in lower powers. Camera lens corrections are not upset by the supplemental lens (except for negligible chromatic aberration) when the supplemental lens is used with the camera set for infinity. To find the magnification caused by the additional lens, the formula is

$$\text{Ratio} = \frac{V}{U}$$

where V equals camera lens-film distance and U equals supplementary lens-object distance

50-mm. lens
200-mm. supplemental lens

$$R = \frac{50}{200} \text{ or } \tfrac{1}{4} \text{ the size.}$$

Fig. 4 (Wright). Vernal catarrh.

The depth of field is that area on each side of the focused plane which will appear acceptably sharp in the picture. It varies according to the focal length, f-number of the lens, lens-subject distance, and acceptable degree of sharpness (circle of confusion). In general, the smaller the focal length and the f-number, the greater is the depth of field. A general rule is that a lens performs best at one half its maximum aperture (twice its f-number).

Correct viewing distance aids in perspective. The picture should be viewed from the center of perspective, which is the point originally occupied by the camera lens. Only so will the relative angular dimensions be correctly reproduced. A small transparency viewed through a magnifier having a focal length equal to the taking lens suddenly acquires an enormous improvement in naturalness. A picture taken with a 5-inch lens and enlarged three times should be viewed at 15 inches and thereby appears more realistic. Pictures projected on a screen should be viewed at the projector-screen distance times the ratio of camera lens-focal length to projector-focal length. Departure from this relation by more than twice markedly reduces the realistic reproduction.

B. Filters

Filters are transparent pieces of colored glass, or gelatin between glass, mounted so that they can be attached to the camera lens. In ophthalmic photography they are used, when necessary, to enhance certain color tones (warmth), or convert different light temperatures to the film requirements. They are not always necessary but are specified by the manufacturer of the film whose recommendations should be carefully followed.

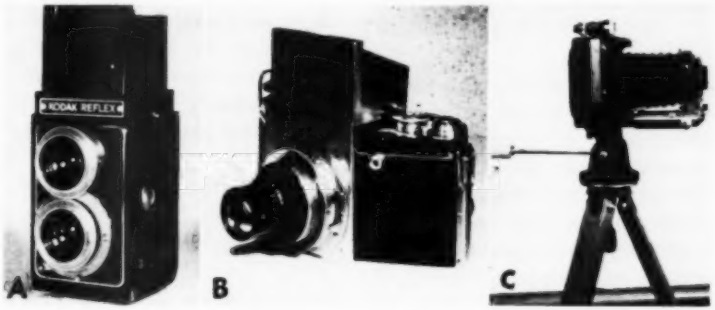


Fig. 5 (Wright). Suitable types of cameras. (A) Twin-lens reflex. (B) Single-lens reflex. (C) Double extension bellows.

In addition, Polaroid filters may be used to diminish corneal reflections. White light striking a glass surface at an angle of incidence of 57 degrees from the normal is perfectly polarized. This is one of the three ways in which natural light is polarized and the chief one with respect to the cornea. At angles other than 57 degrees the light is partially polarized. The Polaroid filter stops the polarized (glare) light and passes the unpolarized (diffuse) light when it is turned so that the polarizing element has its axis at right angles to the axis of the polarized light. This position is really determined by looking at the cornea through the filter and turning it until the glare disappears. Since the filter stops part of the light, the exposure must be greater (roughly, one full stop).

C. Film

The advantages of color photography are so great that the use of black and white film is rarely indicated. Only color film can show the details of inflammation, pigmentation, and fine structure. For 35-mm. cameras, Eastman's Kodachrome Type A or Kodachrome, Daylight Type, and Ansco's Daylight or Tungsten film are available. For larger cameras, each company provides sheet film in both daylight and tungsten types. Such film is for positive transparencies. Kodachrome film, either daylight or tungsten type (K828), may be used with an adapter in larger cameras to obtain the economy of small-size film and positive transparency. In addition, roll film may be used although Kodacolor is a negative transparency. Preference for one or the other is an individual matter.

D. Lighting

There are several methods. One is the use of flood lights of the recommended color temperature for the film in use. This method can produce good pictures but has many disadvantages, namely, excessive heat, glare, and bulkiness. Moreover, a child will not readily tolerate the discomfort, and various switches are needed to focus in dim light and then turn on full brilliance for the picture.

A second method is the use of a projector lamp (that is, a T10) enclosed in a tube. This can be combined with a camera shutter to give just the right exposure time but is also bulky and requires an extra focusing

Fig. 6 (Wright). Congenital coloboma of iris (from a color transparency taken with a single-lens reflex camera).

light. It is not so suitable for full face. It may require a filter to convert to the correct color temperature.

A third method is the use of flash bulbs. This includes stroboscopic flash bulbs. This method entails some expense for each bulb but is virtually fool-proof. Provided the camera setting is proper, a good picture is obtained with every exposure. There are suitable bulbs for each film. The Speed Midget bulb with a time of exposure of 1/200 seconds gives adequate light, stops motion of the eye, and requires no filter with Kodachrome, tungsten type film. Used with an f:2.8 lens (50-mm. focal length) with a 35-mm. extension tube, an aperture of f:8 for brown eyes and f:11 for blue eyes has proved satisfactory when the lamp is held at 14 to 16 inches. One test roll will quickly establish the optimum for the combination used. With Ansco tungsten film, a filter is necessary to eliminate excessive blueness; with Kodachrome tungsten film, no filter is required. With daylight type film and blue bulbs, no filter is required.

E. The camera

The problem is the conversion of a lens system whose near point is 3 to 4 feet to a system that will focus at 6 to 8 inches. The most universally used cameras are those of the miniature type. They have short focal length, speedy, highly corrected lenses, are compact, and have a wide variety of auxiliary lenses and other equipment. In addition, their transparencies are readily projected and make excellent slides. They range in size from 35 mm. to 2¼ by 3¼-inch machines.

There are two general types. One employs an eye level or split-field rangefinder, that is, the Leica, Contax, Clarus, Argus, and so forth. To adapt these for eye photography a copy attachment is used, and focusing is done with the ground glass of the copy attachment after which the camera is slid into place and the picture made. The camera is focused with the lens wide open and the lens must be stopped-down prior to releasing the shutter. This method is slow and involves many steps but for the owner of this type of camera it is perfectly satisfactory in results.

The second type is a single lens reflex camera. Here, focusing is done through the taking lens, with the ground glass already in the camera. Either a supplementary lens or an extension tube is used for the close up, just as in the previous system, except that here focusing requires only one step. The lens must be stopped down after focusing prior to releasing the shutter. This method is considerably faster than the preceding one. Examples of such cameras are the Exacta, Graflex, Korelle, and Praktiflex. The Graflex has an automatic stop-down which enables wide open focusing and automatic stop-down on snapping the picture. It is the simplest of all.

A third method is the use of a twin-lens reflex camera such as Rolleiflex, Ciroflex, Kodak, and so forth. Here the focusing is done directly and no stop-down is required, as the taking lens is simply left at the proper setting (f-stop). This would be ideal except for the problem of parallax. The viewing lens is above the taking lens and for close-up work does not correct for the difference. There are attachments which overcome this; or, after focusing, the camera may be elevated the required distance. To adapt this fine camera for eye work, a +5D. meniscus lens is placed on the lower lens by use of an

adapter ring and a +5D. lens, with a 14-degree (24.5 diopter) prism ground in it, is placed base down in front of the viewing lens. These may be obtained from the optician. With the object at 8 inches, very slight focusing is required and the normal lens setting is used. An 828 film in a proper adapter makes this a precision instrument for fine miniature films. The transparency can be projected in a 35-mm. standard projector. For full-face shots the supplemental lenses are removed and the regular focus at 3½ feet is used.

The fourth method is the use of a camera with a double extension bellows. Focusing is done by viewing through the ground glass at the back of the camera, after which film plate is inserted, lens stopped-down, and picture made. This is a perfectly feasible method but quite slow and subject to blur if the camera is moved while inserting film plate.

With the fast exposure of a flash bulb, elaborate fixation of the patient's head is not necessary. The chin and head rest of the slitlamp are sufficient, and there is room behind the slitlamp to mount a camera. It takes only a moment to position the patient, focus, and flash the picture. Synchronization is not necessary. Open flash (bulb) is preferable because the distance of the flash gun (held in the hand) can be varied at will. Generally, a distance of 14 inches and partly to the side is best. Lighting directly in front of the eye (at the camera) does not give as good texture definition as cross lighting from the side.

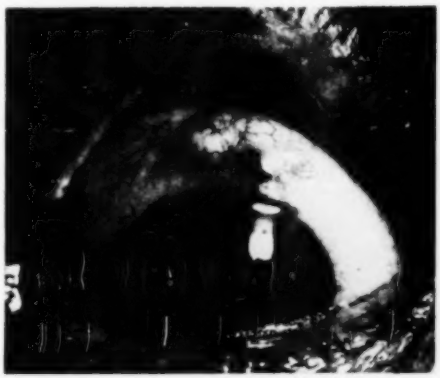


Fig. 7 (Wright). Subconjunctival aqueous in an iridencleisis (from a color transparency).

Summary

An elementary review of photographic optics is presented. Lighting methods are enumerated, methods of photography of the anterior segment of the eye are detailed, and advantages and disadvantages are set forth. A method of converting any ordinary camera to anterior segment photography is described.

511 South Bonnie Brae Street (5).

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TALC GRANULOMAS OF THE EYE*

G. L. McCormick, M.D., W. L. Macaulay, M.D., and G. E. Miller, M.D.
Marshfield, Wisconsin

In 1912 Lambert[6] first demonstrated the ability of foreign-body substances to stimulate the production of giant cells in tissue cultures. Two decades later Antopol[1] called attention to the clinical and pathologic significance of Lycopodium powder granulomas in surgery and suggested that talcum powder was capable of producing the same reaction. Since then, a fair number of reports have appeared in the literature on granulomatous reactions resulting from the accidental introduction of Lycopodium spores or talcum powder into surgical wounds. As a rule, the gloved hand of the operator is the source of contamination. The abdominal cavity has entertained the greatest number of the reported talc granulomas, but this site is by no means exclusive. Other portions of the body where such lesions have been found include the scalp,[5] brain,[4] maxillary sinus,[4] neck,[1] breast,[1] pleura,[10] bladder neck,[1] epididymis,[1] cervix,[8] vagina,[9] rectum,[7] and other regions. To our knowledge a foreign body granuloma of the eye due to talcum powder has not previously been recognized and consequently is worthy of a report in the literature.

Case report

History. Mrs. C. J., a white woman, aged 32 years, was seen on September 23, 1947, complaining of rapidly growing tumor masses on the temporal and nasal portions of the right eye. She claimed the lesions were first noticed about two weeks before. Their exact duration was unknown, but the patient emphatically denied the possibility of their existence a month previously. In fact, aside from alarm occasioned by the rapid growth of the tumors, the patient was annoyed because each of her aquaintances, when met, was startled and inquisitive about her eye. There were no subjective symptoms. There was no history of recent injury.

A review of her past history revealed that on August 18, 1933, a right convergent strabismus, originating in early childhood, had been corrected by resection of the right external rectus muscle and partial tenotomy of the right internal rectus muscle. The postoperative course was apparently uneventful; and, to the patient's knowledge, wound healing was not abnormally prolonged. Other incidences in the past history included an appendectomy in 1932, a Neisserian vulvovaginitis and urethritis associated with a Bartholin gland abcess in 1934, and bronchopneumonia in 1941.

Examination of the right eye disclosed smooth, semitranslucent, grayish tumor masses temporally and nasally at the sites of previous muscle surgery (fig. 1). The mass on the temporal side was larger and measured 10 mm. by 4 mm. The other was only slightly smaller. There was slight injection of the adjacent sclera, and telangi-

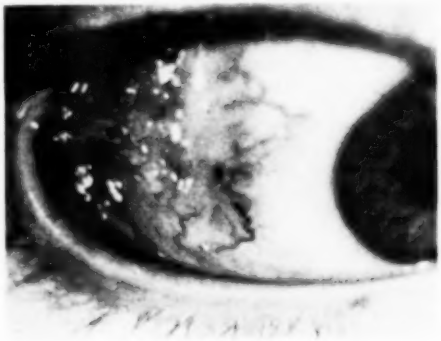

Fig. 1 (McCormick, Macaulay, and Miller). Showing semitranslucent tumor mass on temporal portion of right eye at site of previous eye muscle surgery.

* From the Departments of Ophthalmology and Dermatology, Marshfield Clinic.

ectatic vessels coursed over the tumors. The differential diagnosis this time included keloid, sarcoidosis, and lymphoblastoma. The blood and urine were normal. The serologic test for syphilis was negative. There were no lesions of the skin. Roentgenograms of the chest as well as the small bones of the hands and feet revealed no evidence of sarcoidosis.

On September 24, 1947, a biopsy was performed. The pathologic findings were as follows.* "The sections consist of dense fibrous connective tissue in which are embedded nodules of epithelioid cells. A few poorly developed multinuclear giant cells are

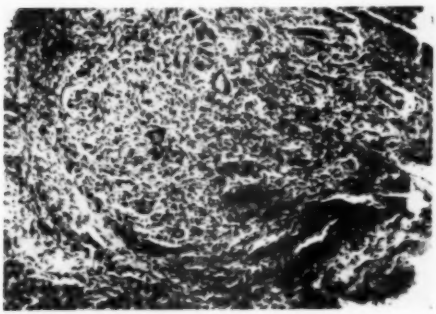

Fig. 2 (McCormick, Macaulay, and Miller). Showing typical foreign-body reaction consisting of dense fibrous tissue, epithelioid cells, and a few giant cells. Small crystals (not visible at this magnification) are scattered throughout this section. (×98.)

present. Many of the nodules contain particles of unstainable crystalline material which is birefringent and which in size and shape resembles talc" (figs. 2 and 3).

On October 14, 1947, the conjunctiva was reflected and both masses were surgically excised. The pathologic report was: "The findings in this specimen are similar to those of the previous specimen except there is some lymphocytic infiltrate associated with the epithelioid nodes. The pathologic changes resemble those found in sarcoidosis, but apparently represent a tissue reaction to the foreign crystalline material which is probably talcum powder."

Following surgery, convalescence was uneventful and the wounds healed promptly. Follow-up examinations at 2 and 6 months showed no recurrence. A slight roughness persisted at the excision sites.

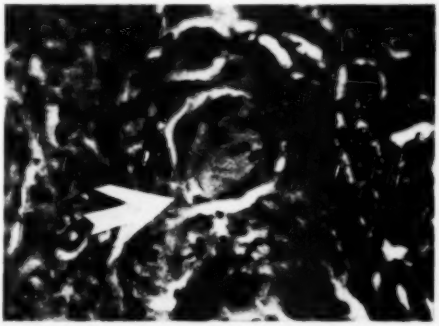

Fig. 3 (McCormick, Macaulay, and Miller). This section shows a large giant cell enclosing a talc crystal. (×330.)

Discussion

This case is of interest from several standpoints. Although talcum powder has been known to produce foreign-body granulomas in almost all tissues of the body, this is the first recorded case of such a lesion occurring in the eye. There are several reasons why this apparent rarity may be valid. The operative field in ocular surgery is small. The manipulations are minute. Instruments provide accessibility. The possibility of the accidental implantation of talc in eye surgery is considerably more remote than, for example, in abdominal surgery.

On the other hand, missed diagnosis may in some degree account for the rarity of this lesion in the eye. It must be admitted that the medical profession as a whole is still not entirely aware of the dangerous potentialities of talcum powder in surgery. It is known that many talc granulomas found

* We are indebted to Dr. Hermann Pinkus, Monroe, Michigan, for preparation and interpretation of the histologic specimens.

elsewhere in the body were originally diagnosed as tuberculosis or some other disease, and only after restudy was the true nature of the lesions disclosed. It has been suggested[2] that the granulomatous masses often seen for many weeks at the site of eye muscle surgery might conceivably be foreign-body granulomas due to talc. These lesions should be investigated histologically.

The fact that some of these tumors may assume a sarcoidlike structure microscopically has already been pointed out by German.[5]

A most unusual feature in this case is the prolonged interval (14 years) from the original eye muscle surgery (the year of Antopol's first report) when talc presumably was implanted to the first signs of growth of the granuloma. In analyzing 37 cases of talc granuloma, most of which developed following abdominal operations, Eiseman and others[3] pointed out that the time interval between the original operation and the appearance of symptoms varied from the immediate postoperative period to 10 years. German's patient[5] first developed signs of activity 14 years after the original wound. Lichtman and others[7] reported that a nodule which first appeared in a scar on the forehead 36 years after the original laceration was found microscopically to contain talc. Hence, although one may expect symptoms of talc granuloma to appear in early weeks or months following implantation of the crystals, such is not always the case. The spontaneous appearance of both lesions at the same time is also impressive.

It is interesting to note that in 1945 Chamlin[2] conducted a series of experiments in which he introduced talc into portions of rabbits' eyes. He was prompted by curiosity to learn if a talc granuloma could actually be produced in the eye since none had been reported. The experiments were planned to simulate the accidental introduction of talc during accepted ophthalmic operations, such as trephination of the anterior chamber, iridectomy, and eye muscle surgery. In most cases typical talc granulomas were produced. Chamlin realized that in eye muscle surgery the operative field is widely exposed and vulnerable to talc contamination in contrast to intraocular operations. He intimated that a talc granuloma of the human eye, when discovered, would most likely be at the site of such an operation. His prediction is fulfilled.

SUMMARY

A case is presented in which talc granulomas developed at the sites of eye muscle surgery 14 years after the original operation.

This is apparently the first recorded instance of such a lesion occurring in the eye.

Marshfield Clinic.

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INTRAOCULAR FOREIGN BODIES*

Fifty consecutive cases

J. P. McBride, M.D.
Los Angeles, California

The ophthalmologist engaged in the treatment of eye injuries must always be alert to the possibility of an intraocular foreign body. Fortunately, most of these bodies encountered in civilian practice are magnetic, and the surgeon has a good chance to extract the missile and recover a useful eye. Among military personnel the problem is different, for then foreign bodies are frequently multiple, often only mildly magnetic, and many times are associated with wounds that take precedence over the eye condition. Although most cases in civilian practice are easily diagnosed, an occasional one taxes the ingenuity of the surgeon and requires the use of all the available diagnostic procedures before it can be handled. Even then, success sometimes falls short. This report concerns 50 consecutive cases of foreign bodies encountered in civilian practice during the past two years.

Etiology

The accident resulting in an intraocular foreign body most commonly occurs when a metal object is struck by a hammer, causing particles of steel to fly through the air at high velocity. The striking of a king pin with a hammer ranks highest as the source of such injuries. The pounding of a cold chisel with mushroomed edges is a usual cause. One patient, a woman, received her injury while operating a punch press; one didn't know how he was injured; and another was injured by a shell explosion. The majority of the foreign bodies were less than 3 mm. in their greatest dimension, but not less than 0.5 mm. In four cases the foreign body was over 5 mm. The particles were magnetic in 45 cases, nonmagnetic in 3 cases, and questionable in 2 cases. In all of the cases, there was only a single foreign body.

Diagnostic procedure

The history of an eye injury is extremely important. If a patient tells a story indicating the possibility of a flying object, especially metal, X-ray studies are ordered as a matter of routine, not only as aid in diagnosis, but also as a protection against those who are malpractice minded. Although these X-ray examinations result in five negative reports for every positive one, compensation carriers agree to the necessity of X-ray studies, for they know the difficulties that can be caused by an intraocular foreign body which is not located.

The external eye should be searched for indications of a penetrating injury. A subconjunctival hemorrhage, although often seen, should not be dismissed lightly. A double subconjunctival hemorrhage may indicate a double penetrating wound of the globe.

A slitlamp examination of the anterior segment of the globe should be made. A quick easy method for picking up an iris window that might otherwise be missed is by transillumination of the globe. (A small 85-cent, pencil flashlight serves this purpose well.) Verhoeff gives credit to "an astute observer, who observed that an incarceration of iris in a corneal wound was proof that no foreign body was in the eye"—a statement which I, too, believe to be largely true.

The lens should be studied with a dilated pupil, for one often first becomes aware of the presence of an intraocular injury by noting a lens lesion with the ophthalmoscope.

* From the college of Medical Evangelists. Presented before the Los Angeles County Medical Society, Section of Ophthalmology and Otolaryngology, February, 1948.

Groovings of the vitreous and isolated retinal hemorrhages should put the surgeon on guard. Frequently a foreign body can be seen directly if a careful search is made.

The magnet test must not be overlooked. The tip of the magnet should be held where the presence of a foreign body is suspected. Any indication of pain by the patient or bulging of the tissues toward the magnet tip should be noted. However, a negative response does not rule out a magnetic object.

The surgeon would do well to apply the magnet to all penetrating eye wounds before repair, in order to avoid repairing a wound and later discovering a foreign body in the globe. It is my practice to apply the magnet to the globe while observing small steel particles with the ophthalmoscope. This gives me information regarding the degree of magnetism. If the foreign object is nonmagnetic or only mildly magnetic, I prefer to expose the metal to the giant magnet daily for several days, in order to increase the magnetism before attempting removal. In two cases herein reported, the first attempt to extract the particle resulted in failure. After repeated exposures to the magnet, however, and with the help of the Berman locator, the particle was removed.

X-RAY LOCATION

At least 30 methods of intraocular foreign body location are described in the literature. Roentgenologists uniformly use the Sweet method, while ophthalmologists who locate their own foreign bodies utilize all other methods except the Sweet, the Comberg, perhaps, being the most popular.

Sweet's method of location involves the use of rather expensive equipment and a knowledge of X ray not ordinarily possessed by the ophthalmologist, while Comberg's technique can be employed with relatively simple and inexpensive equipment. While in the military service, I found the Comberg method to be quite satisfactory when it was necessary to do my own locating, or when the roentgenologist and his Sweet equipment were not available.

It is well to share medicolegal responsibility with the X-ray physician, who has a genuine interest in the problem and who is able to make a more accurate X-ray diagnosis than most ophthalmologists. In only one case in this series was the foreign body missed by the roentgenologist and, after recovery, it was found to measure less than 0.5 mm. in its greatest dimension. Instances of the failure of X ray to locate metallic bodies measuring 0.25 mm. or less are cited in the literature, and are certainly understandable.

At times the X-ray report will describe a radio-opaque foreign body in the region of the sclera and indicate that it might be either in or out of the globe. The following cases will illustrate.

Case 1. L. B. presented himself with a tiny corneal penetrating wound at the 12-o'clock position at the limbus. There was an iris window behind the wound, a clear lens, a fine line in the vitreous, and a fresh retinal wound 2 disc diameters above the disc. X-ray films showed a foreign body, 0.5 by 0.5 by 4 mm., located 4 mm. above the horizontal plane, 3 mm. to the nasal side of vertical, and 23 mm. back of the corneal center. This would place the object in the region of the sclera. Under direct observation, with the magnet applied to the globe, no movement was noted in the retinal wound. The patient was kept under observation and, after a period of two months, the retinal wound was healed. The magnet test did not demonstrate a foreign body in the scar. Accordingly, I believe that the foreign body is behind the globe. The vision has remained 20/20.

Case 2. In another case, reports from two X-ray physicians located a metal particle in the region of the sclera near the equator. Both reports agreed that it was outside of the globe. Since the lens was clear, I was able to observe the retinal wound. Movement was noted in the scarred area when

the magnet was applied, although the patient had no pain. With the help of the Berman locator a tiny fragment was removed and the eye maintained normal vision.

X-ray evidence must be interpreted in the light of clinical findings in the eye just as in other parts of the body.

Reports of the injection of air into Tenon's space to differentiate the position of a foreign body are numerous in the literature, but I have found the method difficult and often disappointing. It isn't easy to get air into the space and, if a wound is present, it may escape. The shadow cast by the air column around the globe is often incomplete and indistinct.

The Berman locator

This instrument, developed by Mr. Samuel Berman, an electrical engineer, and Dr. J. J. Moorhead, both of New York City, utilizes electronic principles to determine the location of metallic bodies embedded in tissues. This locator, first used successfully in 1941, is equipped with a meter indicator on the control panel to show when a foreign body is near, as well as a horn that sounds with increasing intensity as the foreign body is approached. The operation of the machine is simple and requires only a few minutes' study to tune properly and set in operation. This Berman instrument has proved to be a valuable supplement to X-ray localization.

Case 3. A case was referred after two attempts to recover a foreign body had failed. X rays located a radio-opaque object in the region of the sclera, near the equator. It was thought to be nonmagnetic, since two attempts with the magnet had failed to recover it. The sclera was exposed, the Berman locator was applied to the area, and an immediate response was elicited. An incision was made at the exact site indicated and a small, embedded magnetic particle was removed from the sclera.

This instrument has been employed repeatedly and found to be extremely useful, but it has its limitations and they should be made known. Regarding the detection of foreign bodies of various sizes and compositions, the following paragraph from an article by Mr. Berman is quoted: "The distance from which a magnetic foreign body will be detected depends upon its size and composition. Soft iron and ordinary carbon steel are the most responsive. Alloy steels, such as ball-bearing steel, and high-speed tool steel are less responsive. Certain stainless-steel alloys are entirely nonmagnetic and will give no response. The sensitivity of the locator to nonmagnetic metals is relatively low and not always helpful."

The following case illustrates the limitations of the Berman locator.

Case 4. B. H. was injured in the right eye which presented a tiny penetrating corneal wound at the 7-o'clock position near the limbus, an iris window, a clear lens, and a visible metallic object lying midway on the retina. An X-ray report described this particle as measuring 0.5 by 1.5 mm. By direct observation, this foreign body was found to be magnetic. It would move with application of the magnet but never out of its bed. An attempt to recover the particle failed.

For 15 days, the eye was exposed to the giant magnet daily in an effort to increase the magnetism of the foreign body. Again an attempt to recover the foreign body failed. In both attempts the Berman locator was used over the sclera, the tip of the instrument being brought within 1 mm. (the thickness of the sclera) of the particle but a response was never received.

This case illustrates that the Berman locator has limited usefulness when the particle of metal is small and only mildly magnetic.

Removal of foreign bodies

Anterior versus the posterior route

Hoab, Verhoeff, Duggan, and others advocate the attempted removal of most intraocular foreign bodies by the anterior route.

The procedure involves dilating the pupil; placing the magnet tip, preferably a giant, over the corneal center; pulling the foreign body forward toward the lens, through the zonule, and into the anterior chamber; and a final extraction through a keratome incision.

Verhoeff especially warns against trying to remove the body through a corneal wound of entrance, as additional scarring may result and the chances of infection will be increased. He describes a corneal section as close to the limbus as possible. A corneal shelf, which at times may prevent the foreign body from entering the wound as it is being extracted, should be avoided.

If there is a large corneal wound of entrance, the group advocating the anterior route is mostly agreed that the foreign body might be removed directly through it. Of course if the particle cannot be pulled into the anterior chamber, the posterior route must be resorted to.

The main advantage of removal by the anterior route, according to this group, is that retinal separation occurs less frequently than when the sclera is incised. Sherman reports 82 cases of posterior-segment foreign bodies, 44 of which were removed through the anterior route, and 27 through the sclera. Eleven were not removed. Retinal separation occurred once in each method of removal, and both patients recovered, without surgery and with 20/30 vision.

Some authors object to the posterior route, claiming that the late end results are not good and that vitreous disturbances and trauma to the sclera, choroid, and retina too often result in degeneration of the eye. These authors claim that there is no injury to the lens when the foreign body is pulled into its center. Gulliver reports the largest single series, 1,800 cases, and claims that removal by the posterior route was necessary in only 6 cases.

Allport, Shoemaker, de Schweinitz, Sweet, Stieren, Weiner, and others are just as enthusiastic about using the posterior route as the above group is about using the anterior route for removal of foreign bodies.

The posterior method involves attacking the foreign body through the sclera as close to the object as possible. The advantages of this method are that it is usually easier; a giant magnet is often unnecessary; dragging on the choroid and retina is prevented; disturbance of the vitreous is held to a minimum; and retinal separations are not increased.

Stieren reports good results in 700 cases in which the anterior route was not used at all. Sweet objects to the anterior route on the basis that powerful magnets further embed foreign bodies in eye structures, make removal more difficult, and increase trauma to the eye. Shoemaker states: "If the anterior segment is intact and uninjured, I certainly would not injure it by dragging the foreign body through it, and then further injure it by taking the foreign body out of it."

Various methods of piercing the sclera are described in the literature. Lancaster advocates diathermy incision to avoid hemorrhage. Some writers describe methods that penetrate the sclera only and then pull the foreign body through the choroid and retina. Others make a shallow stab wound of all three coats with the Graefe knife. Some advocate making the scleral incision between two scleral sutures, claiming better control of the wound by this method. Some follow a routine of laying down a barrage of diathermy punctures about the scleral wound to prevent separation of the retina.

Verhoeff tells of a scleral incision parallel to the ora serrata and over the pars plana of the ciliary body, just 5 to 6 mm. from the limbus. This incision would be anterior to the vitreous body, and the pars optica retinæ. Here the retina is very thin and firmly attached, and the area is relatively avascular since no choriocapillaris is present. Barbour and Fralick follow Verhoeff's procedure, but penetrate the sclera by trephine. With this method, the sclera only is pene-

trated and the foreign body is pulled through the ciliary body.

Methods used in this series

Both routes of removal were used in the cases of this report, for each method appears to have its own indications. If the foreign body is situated in the anterior segment, it is agreed that it should be removed through the cornea or the wound of entrance, if near by. If possible, particles in the lens should be pulled into the anterior chamber and then removed through a keratome incision. If a body in the lens cannot be pulled into the anterior chamber, then a lens extraction might become necessary.

Metallic particles in the vitreous, when the lens is clear, are best removed through the posterior route. If the lens is damaged, I can see no serious reason why the particle should not be pulled into the anterior chamber if the surgeon desires. Especially is this a good method if a large corneal wound of entrance exists. The posterior route becomes a necessity at times, for some foreign bodies, especially small ones, cannot be pulled into the anterior chamber even with the giant magnet.

The method of procedure in this series is that used by Dr. John N. Osburn in over 700 cases in the past 27 years. A stab wound of the sclera, choroid, and retina is made as close to the metal object as possible. The blunt tip of the magnet is first applied to the wound for a few moments. If there is no response, a pointed tip is placed in the lips of the wound. If necessary the tip of the magnet is placed in the vitreous, but this is avoided if possible. The Berman locator is usually set up in the operating room and is used to point out the exact spot to incise the sclera. There appears to be no advantage in incising the sclera only and pulling the foreign particle through the retina and choroid. Scleral sutures have not been found necessary. Diathermy punctures about the wound are not used unless there is an actual separation, but surely there can be no objection to their use.

When the anterior route is used, I believe it advisable to remove the foreign body through the wound of entrance, if the case is seen early, and especially so if the wound is large and the anterior chamber collapsed. However, it is often difficult to pull small particles of steel into a tiny wound of entrance. Under such circumstances, it is best to remove the object through a keratome incision.

In this series, the posterior route was used in 25 cases, or 50 percent; the anterior route in 19 cases, or 38 percent; and in 6 cases, or 12 percent, the foreign body was not removed. In 15 cases, 30 percent, the foreign object was removed through the wound of entrance.

Complications

Four cases, 8 percent, of retinal separation were encountered that warrant a word of explanation. In 2 of these cases, the foreign bodies were not recovered. In one case, the eye is now blind, but the globe remains in good condition. Vision in the other case is normal, following repair of the separation, and the patient is being kept under observation. In the third case, a separation developed after removal of a large foreign body, 6 mm. long, that had transversed the globe. A repair was done and, when last seen after an interval of five months, the eye had 20/60 vision. An extensive detachment developed in the fourth case following two unsuccessful attempts at removal of the foreign body, the third attempt being successful. The patient now has a blind eye, but the globe remains in good condition.

Two cases of glaucoma resulted. One of the patients had had a blind eye for eight years, but did not know of an injury. Examination showed a healed penetrating wound on the cornea, an iris window, and a mature cataract. Tension was 60 mm. Hg (Schiøtz). X-ray examination located a tiny piece of metal in the region of the lens. The

lens was extracted and the foreign body was found in the capsule. The operation relieved the glaucoma, but the eye was blind from glaucomatous atrophy. In the second case glaucoma developed three months after removal of the foreign body, and the eye was enucleated.

Endophthalmitis resulted in 6 cases, macular degeneration in 1, and blood staining in the cornea in 1 case. Lens lesions resulted in 15 cases, or 30 percent.

End results

In 19 cases, 38 percent, normal vision was recovered and there was no permanent disability. Ten eyes, 20 percent, were enucleated. Nine blind eyes, 18 percent, were not enucleated. In 8 cases, 16 percent, aphakia resulted, and of these 6 had better than 20/50 vision, 2 had less than 20/50 vision. Two cases of cataract have not been operated upon. No central vision was the end result in 2 cases.

Summary

1. The procedures for locating intraocular foreign bodies are discussed.

2. The Berman foreign-body locator is a valuable supplement to the present methods of location.

3. The methods of removal of intraocular foreign bodies are outlined, and the literature is reviewed.

4. Fifty consecutive cases of intraocular foreign body are reported.

1052 West Sixth Street (11).

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Historical Miniature

Egyptian Ophthalmology

The Ebers papyrus also mentions the famous eye cosmetic which has a 4,000-year history. No Egyptian woman was ever without it. There were two kinds. The one was essentially lamp black; the other, the expensive, imported, finely pulverized, natural antimony sulfide (Sb_2S_3).

Hirschberg, *Graefe-Saemisch Handbuch.*

THE HANDLING OF THE AMBLYOPIC PATIENT*

MAYNARD C. WHEELER, M.D.
New York

When Dr. Post asked me to take part in this symposium, it occurred to me that a description of how we handle the amblyopic cases at Vanderbilt Clinic might be of general interest and should provide the basis for discussion.

HISTORY

The history is of particular importance in the handling of the amblyopic patient. It is amazing how many ophthalmologists seem to feel that a history is not work taking, at least if one can judge from many clinic records. The date of onset, while often unreliable, is still worth recording as accurately as possible. There is general agreement that the earlier the squint develops and the greater the proportion of the patient's life it has been present, the longer it will take to restore vision.

It has surprised me that frequently the parents are not sure which eye is turning and frequently will name the wrong one. This may become important when asking for intelligent coöperation in carrying out the treatment. It is vital to know which eye they think turns when surgery is being performed, to avoid a misunderstanding. Usually, however, this information is given reliably. The history of a weak eye in several members of the family is frequently volunteered.

The story of previous treatment should be recorded carefully, with any comments as to the results.

VISION

Anyone who has seen the bizzare and completely fantastic visions written on the clinic charts, in good faith, by trained nurses, will realize that it is not the simple, routine task that it may seem. One must be on guard particularly in children with one poor eye. The desire to cover up a defect and to make a good score is strong; so that peeking, memorizing, and guessing must be carefully guarded against.

In our clinic, we are satisfied with the results that we get with separate E's mounted on white plastic squares. We know that we get better visions than with the Snellen cards but, as it is the comparison of the two eyes that is really important, this is not a serious criticism. Careful technique will rule out peeking and memory. Guessing can only be detected by an alert examiner.

Most children aged four years, can be taught the "E game" and they love to play it. A recent writer has advised excluding other children, and the parents, from the examining room. I strongly disagree. Watching others play the E game has melted the resistance of many of our children. It shows them how it is done, it gives them confidence in us and probably stimulates them competitively. We find it worth while to have the mother start the little ones at home, although we have not bothered with records of visions taken at home.

It must be apparent to everyone who has worked with these youthful squint cases, that it is not necessary to wait until the vision can be reliably tested to know that the child is amblyopic. If any youngster uses one eye habitually, the deviating eye will surely be amblyopic. With experience one can tell by the expression of the squinting eye, and the child's behavior, when the fixing eye is covered, that it is amblyopic. Conversely, if there is alternation, even in just one field, you can be fairly sure that there will be good vision in both eyes. This information is reliable enough to enable us to proceed with treatment with confidence, as will be discussed later.

REFRACTION

The most interesting feature of the re-

* Presented at the seventh annual meeting of the American Association of Orthoptic Technicians, Chicago, October, 1948.

fraction is the inequality in the two eyes. The amblyopic eye is almost always the one with the greater error. If the reverse is true, one should be very suspicious that it is not an amblyopia from disuse. I know of no way to tell how much anisometropia is compatible with binocular single vision, but this must be considered. I am convinced that occlusion is wrong in extreme cases of anisometropia. Aniseikonia may be important as an obstacle to binocular single vision, but our ideas on this are largely theoretical because of the lack of an adequate means for measuring it in squint cases.

Fundus examination

The necessity of a thorough fundus examination, before occlusion, should be evident. I believe this to the degree that I demand an examination under general anesthesia if the child will not coöperate for at least a satisfactory inspection of the discs and maculas. Recently this belief was strongly reinforced when a five-year-old boy was brought to me with an advanced retinoblastoma in his right eye. Two years previously, this child had been treated with occlusion of his other eye, unsuccessfully.

Type of amblyopia

The diagnosis of the type of amblyopia is of great interest but this is largely academic because of the young age of most of these patients. I have no quarrel with the writers who classify these cases by means of their scotomas, but I want to treat these children long before these scotomas can be satisfactorily plotted.

The cases with gross pathologic conditions are easily classified. But there is a group with normal-appearing eyes who do not improve after adequate occlusion. I call this "pathologic amblyopia" and visualize some small lesion in the retina or optic nerve, possibly from birth trauma, that cannot be seen with the ophthalmoscope. I know of no way to separate them from the amblyopias of disuse except by a trial period of complete occlusion. If any case fails to show improvement, or the younger ones fail to switch fixation after two months of complete occlusion, I am inclined to call it "pathologic" and abandon further treatment.

Deviation

The examination of the deviation, in the presence of amblyopia, raises special problems. I am referring here particularly to those patients who lack reliable fixation in one eye. Of course, the cover test cannot be used. Simple inspection can be of great value, particularly when the observer is apparently not paying more than casual attention to the child. Talking to him, while playing with a toy dog whose eyes light up, may enable the examiner to note the displacement of the corneal reflex in the squinting eye. Using the same toy-light, and considerable patience, the excursions may be elicited.

But here a word of caution is necessary: when trying to bring out abduction of an amblyopic eye, it is very easy to be misled into the conclusion that there is a weakness of the external rectus. The child follows the light with his fixing eye until the bridge of his nose intervenes, then movement in that direction stops. He sees the light just about as clearly with the peripheral retina of the amblyopic eye as he does with the macula so there is no incentive to abduct it farther. A day or two of occlusion will usually demonstrate his ability to abduct the eye fully.

With the very young patient, this may be all of the information that can be obtained. The angle of deviation must be estimated by the displacement of the corneal reflex, after the method of Hirschberg. This is only an approximation and unsatisfactory, but if that is all that we can get we must proceed.

Soon after the age of two years, in many cases, a prism can be slipped in front of the fixing eye (base out in esotropia) while the patient is watching a light held on the examiner's nose. This will cause a shift in the fixing eye toward the apex of the prism and a corresponding movement of the squinting eye. When the prism is found that corresponds to the angle of the deviation, the

reflex will be centered in the cornea of the amblyopic eye. This is the prism reflex test, described by Krimsky, which I believe to be both the most convenient and the most accurate method for measuring the deviation for "near" in amblyopic cases. I believe that it is proper to assume that the angles Kappa are symmetrical in the two eyes and to make an allowance for this. A vertical deviation can be measured at the same time by placing a vertical prism before the fixing eye with apex in the opposite direction.

The perimeter still offers the best method that I have found for measuring the deviation for distance, in these cases. Unfortunately, our perimeters are not usually conveniently placed for this purpose and I am afraid that most of us get along without distance measurements. Theoretically at least, measurements can be made in the cardinal directions with the perimeter but this offers great difficulties and is probably rarely done. A careful study of the excursions, comparing the two eyes, should be part of every analysis, however.

Treatment

There is general agreement, I believe, on the principles of the treatment of amblyopia. The earlier occlusion is instituted, the more quickly will the result be obtained. Frequently a very young child will accept an occluder more readily than an older one. In most cases the important thing is to take time to explain to the mother what is being attempted; how vital it is; and that it will become more difficult with each delay. The mother's coöperation is absolutely necessary and I have rarely failed to get it when the problem was adequately explained. With a few exceptions, occlusion should be begun with an adhesive bandage, worn continuously. As already stated, a trial period of two months is considered adequate to differentiate amblyopia of disuse from the pathologic type. However, after two weeks of satisfactory, complete occlusion, if the eye fails to fix centrally, I am inclined to stop the treatment. Any visual improvement is an indication for continuing occlusion and I favor keeping it up until there is no further gain over 2 to 4 weeks.

There is no fixed point at which the bandage can be abandoned for less drastic measures. This varies with the age, the refractive error, and the season of the year, as well as the progress of the vision. In recent years, I have used the various types of occluders much less and have relied largely on atropine in the fixing eye, and paper on that spectacle lens. Many mothers are able to regulate the use of atropine, putting in a drop when the child starts to look over the glasses, that is every week or 10 days. Once equal vision is achieved, intermittent occlusion, 1 month out of 3, has been the most satisfactory method of maintaining the vision.

A question that is frequently heard is: why all of this bother when the vision usually slips back as soon as the treatment is stopped? True, if no further attention is paid after the original course; but that is not enough. I am well aware of how difficult it is, but we must strive to maintain the vision, by intermittent occlusion, until the child is at least six years old. I cannot prove it, but it is my belief that if the vision slips after this age, and it frequently will, it can be regained later if ever needed.

Another difficult question is: at what age is occlusion no longer effective? Various answers can be found in the literature and there is no doubt that visual improvement has been obtained in individuals, aged 20 years or more. But there is also no doubt that the task becomes increasingly difficult with added years and that the practical obstacles are formidable. Both in my practice and in the clinic, we rarely recommend occlusion after the age of seven years.

I have made no attempt to discuss the part that an orthoptic technician can play in handling these cases as I have not had the benefit of such assistance. There is no doubt that a technician can shorten the treatment period in many instances, and might succeed at times when I have failed. Valuable aid

can also be rendered at home with drawing, coloring, and games that stimulate the desire to see while using the hands. Home movies have always seemed worth while. Maybe this would even be an argument in favor of television.

Occlusion should always be carried out before surgery, if possible. Waiting for surgery causes an undesirable delay. Psychologically, for parents, it works out better. A course of occlusion helps to prepare them for surgery, while on the other hand, after recovering from the emotional upset of an operation, it is human nature to want to forget about the whole thing. Of course, this may not be possible because in the young ones who do not acquire binocular single vision or alternation, intermittent occlusion may be necessary for a long time, but at least the tedious part is out of the way. Another feature that must be mentioned, although I am unable to explain it, is the recurrence of the squint that occurs occasionally during postoperative occlusion. This is not a strict contraindication but should make us proceed with caution.

As soon as the vision has been equalized, or fixation switched, operation is indicated, unless orthoptic exercises are to be employed. Speed is of the greatest importance, here, if one is to take full advantage of the new condition. The eyes should be made as straight as possible in the hope that binocular single vision will be acquired.

When occlusion fails, a cosmetic correction is all that can be hoped for. A surgical undercorrection should be sought because these are the eyes that tend to turn out later.

In an attempt to see what sort of results I was obtaining, I looked over the records of the last 40 patients in my private practice, for whom occlusion had been prescribed. I considered that a serious effort to carry out the treatment had been made in 33. My criteria of success were: (1) In the young children, shifting of fixation to the other eye; (2) improvement of vision to within one line of the other eye. On these criteria, 21 of the 33 cases were successful. The series is too small to make further analysis worth while. No significant difference could be found between the two groups to explain the failures.

Considering the failures, one aspect stands out. I am sure that we have all been impressed by the emotional resistance in the unsuccessful cases. It is not easy to see beyond the intensity of this reaction for the explanation that very possibly is but the normal reaction of a youngster who is forced to have his only useful eye covered. In other words, these obstreperous ones frequently have a pathologic amblyopia and are truly tortured by occlusion. Unfortunately there is no easy way to be sure. Because of this possibility, I tend to give the child the benefit of the doubt.

Conclusion

I have tried to select the points that are peculiar to or of special importance in the examination and treatment of children with amblyopia.

30 West 59th Street (19).

Discussion

F. Elizabeth Jackson, M.A.
Erie, Pennsylvania

Dr. Wheeler has already discussed very completely and ably the problems presented by the amblyopic patient and procedures in office treatment of this condition. The handling of the amblyopic patient at an orthoptic clinic is merely a relegation of duties to the technician during the early stages of occlusion and visual development. The problems and methods are the same and are met with the same point of view.

The close correlation of the results of visual achievement in Dr. Wheeler's series of 40 cases with those in a group of 50 cases treated at the Erie Orthoptic Clinic would certainly seem to indicate similarity in treatment. In Dr. Wheeler's group, 21 out of 33 cases, or 64 percent, were successfully treated. In the Erie Clinic group, 32 out of 50 cases, or 64 percent, attained 20/30 vision or better which would seem to be comparable to Dr. Wheeler's criteria of success.

Dr. Wheeler mentions the difficulty of maintenance of vision in the amblyopic eye once it is obtained. It is at this point that the orthoptic technician can make her original and most important contribution.

In this same series of 50 cases with original vision of less than 20/50 in the amblyopic eye, the vision developed by occlusion and supplementary exercises was maintained in 21 cases, or 42 percent for a minimum period of six months. Table 1 shows maintenance in relation to highest vision obtained.

Maintenance of vision

Further analysis shows that three factors in particular have an important bearing on maintenance of vision: (1) Length of occlusion; (2) conversion to alternation; and (3) development of fusion and parallelism.

Length of occlusion

An analysis of length of occlusion in this series shows that, in general, best results were obtained in those cases which were occluded for longer periods. The majority of cases were occluded from 4 to 12 months. Maintenance in the 12-month group was 100 percent as compared to 27 percent in the 4-month group.

TABLE 1

Maintenance of vision in relation to highest vision obtained*

Highest Vision Obtained	Number of Cases	No. Cases Vision Maintained	Percent Maintained
20/20	4	1	25
20/25	12	4	33
20/30	16	8	50
20/40	7	3	43
20/50	7	5	71

* In those cases in which final vision of 20/50 was obtained, the original vision was 20/100 in 1 case and 20/200 or less in 6 cases.

This might seem to be the solution to our problem except for the coöperational difficulties involved in long occlusion, especially in older children. When the child is first patched and forced to use his amblyopic eye, with vision usually of 20/200, the parent is sufficiently impressed with his obvious visual difficulties to coöperate completely. During early stages where visual development tends to be rapid, the child himself is pleased with his progress. But later, when vision is improved, the patch gets to be an "old story," and when it can come off part time, its partial use is apt to become slipshod. Too often, everyone becomes discouraged, and the original effort is wasted.

The technician who is giving fusion training during this period of partial occlusion is at an advantage. Frequent clinic visits maintain emphasis, if not always interest. Monocular exercises can be assigned for periods when the patch is on, binocular exercises for periods when it is off, thus making the spacing of occlusion logical rather than arbitrary.

Conversion to alternation

Dr. Wheeler mentions shift in fixation as a criterion of successful treatment. It is indeed, for a patient with amblyopia of long standing may continue to fix with the originally good eye, although, after long occlusion, its vision is lower (for the time being) than that of the amblyopic eye.

When spontaneous alternation of fixation can be developed, no loss of vision occurs after occlusion is discontinued whether or not fusion and parallelism are achieved. It has been our experience that development of such ability is possible only in the very young child where the deviation is necessarily of short duration. Four cases only of the 50 studied became natural alternators after oc-

clusion and orthoptics. Their ages when treatment was begun ranged from 2½ to 4 years. Thus, may I add another reason to Dr. Wheeler's in his insistence upon early occlusion.

Development of fusion and parallelism

Of the 21 cases in our series who maintained all of their visual improvement, 4 cases (as previously mentioned) achieved alternation, 3 were occluded for 12 months or longer, and 14 attained parallelism with fusion—that is, they developed the ability to hold their eyes straight in daily life and had fusion under some conditions of distance, size of object of regard, and amount of effort involved. Thus it would seem that achievement of parallelism with fusion, whether by surgery, orthoptics, or both, is the largest factor in maintaining vision. There is nothing startling in this finding. Both eyes are being used; disuse is not present; therefore, one would not expect loss of vision.

However, 11 cases did not maintain total visual improvement by achieving parallelism and fusion. Seven cases dropped to 20/50 still maintaining binocular ability; 4 cases dropped to 20/70 or less with loss of parallelism and fusion. In those cases where loss of parallelism and binocular function occurred along with loss of vision, we can conclude that, although possible, fusion required too much effort to become established as a daily habit, or that coöperation and persistence were not equal to the task, or that the case was dismissed prematurely. But in those cases where binocularity remains in spite of visual loss, we must consider the nature of the binocularity present and look for deficiencies in that function. It is apparent that binocularity will insure maintenance of vision at the 20/50 level, but not necessarily above that.

Criteria for classification

Criteria for classification of parallelism and fusion were: (1) Phoria only on cover test; (2) fusion on small targets on synoptophore at zero setting; (3) fusion on Worth-4 dot; (4) fusion on fixation light with red cover before dominant eye; (5) appreciation of physiologic diplopia.

Deficiencies in binocularity

None of the 50 cases studied showed true stereopsis as tested on Keystone diagnostic slides DB6 and DB60. Some of the patients were too young for this test. Many patients were able to fuse synoptophore targets with parallactic displacement, and many gave accurate responses of depth perception. However, we have found that familiarity with the targets may make this possible by monocular criteria, and does not prove the presence of accurate depth perception.

In some cases, although physiologic diplopia was appreciated, indicating the use of both eyes, certain deficiencies appeared. Some patients were unable to localize one or both diplopia images correctly. Frequently, when the images could be properly spaced by movement of the bar to and from the nose, bar-reading remained an impossibility because the bar-image of the amblyopic eye remained solid, although the second shadowy bar was clearly present.

How are we to explain these deficiencies? The most obvious explanation is continuance of suppression of the macular area of the amblyopic eye in spite of peripheral binocularity. This, of course, would preclude stereopsis and explain inability to bar-read.

Another explanation is malprojection of the amblyopic eye. This theory was recently presented by Dr. Lazisch.[1] He believes that "amblyopia ex anopsia is poor vision due to malprojection of the affected eye so that the visual ray is directed eccentrically to the fovea."

Although time has been insufficient to test much of Dr. Lazisch's evidence, some phenomena have appeared during the course of treatment which favor his point of view. Dr. Wheeler mentioned the fact that better vision is obtained when single E's mounted on white squares are used than with Snellen cards. We have found this to be true in-

variably. It also occurs with the use of the Project-O-Scope when any chart letter is exposed singly. The difference in visual acuity when tested by single letter and row of letters varies with the individual tested, but may be as much as four lines.

Another related phenomenon is noted when the examiner stands at the chart and points to the letters. The child will often read correctly and without hesitation the letter next to (usually to the right of) the one pointed out. He will sometimes read two lines further than the correct vision recording in this fashion. This would seem to be a deficiency in fixation or in interpretation of position rather than in acuity itself.

When the amblyopic child is asked to place thumb tacks in the centers of round discs or other geometric figures of varying sizes with the good eye occluded, he will persistently err, and in the same direction—toward the good eye, regardless of the size of the disc. This is interpreted by Dr. Lazisch as evidence of "malprojection of the visual axis," and continued practice in centering as "relearning eye-hand coördination."[2] This phenomenon seems to me to admit of a simpler explanation, namely, directional judgment based on the child's customary monocular usage and coördination of hand with the good eye.

Whatever the explanation, improvement in the patient's ability to center occurs rapidly with daily practice and, although this particular phase of treatment has been tried only recently in our clinic on an experimental basis and with patients whose vision was 20/70 or better, in most cases one line of visual improvement has occurred, and in all cases more stability of fixation has been noted on the synoptophore. It is too soon to judge whether this initial improvement will continue or be maintained.

Whether we explain the binocular deficiences of the amblyopic patient on the basis of macular suppression, malprojection, or a pathologic dominance of the better eye, treatment must be directed toward correction of these deficiencies. They are as much a part of the syndrome as loss of acuity.

Dr. Wheeler has mentioned the use of drawing, coloring, and games that stimulate the desire to see while using the hands. I heartily endorse this procedure and suggest that the element of correct spatial judgment can easily be incorporated into these monocular tasks.

Emphasis in treatment should always be placed on developing ability to fix with the amblopic eye, to alternate fixation at will, and to appreciate diplopia under as many conditions and in as varied visual situations as possible.

Discernment of minute, centrally spaced details with the amblyopic eye should always be insisted upon in training with haploscopic devices. We must aim at the macula to develop acuity. Excellent results in treatment of amblyopia by rhythmic illumination have been reported by Miss Helen Cotter.[3]

I am certain that we have all wondered during the prolonged course of treatment of the amblyope whether our efforts are justified. To persist in treatment in the individual case when no improvement is noted within reasonable limits is certainly futile. We must recognize and accept the variable limitations of the individual case.

Our tabulations of results show 64 percent of cases with satisfactory visual acuity atttainment, maintenance of vision in 42 percent of these, and imperfection in the binocularity of those who attain fusion and parallelism (notably, lack of stereopsis).

Although this achievement justifies the effort entailed, still it is a dubious laurel upon which to rest in smug complacency.

St. Vincent's Hospital.

References

1. Lazisch, B. M.: Amblyopia ex anopsia: A new concept of its mechanism and treatment. Arch. Ophth., **39**:192 (Feb.) 1948.

2. ———: Ibid., p. 187.

3. Cotter, H.: The adoption of rhythmic illumination for orthoptic treatment. Brit. Orthop. J., **4**:48, 1947.

NOTES, CASES, INSTRUMENTS

ESSENTIAL (PROGRESSIVE) ATROPHY OF THE IRIS

PAUL WINSLOW TISHER, M.D.
New Britain, Connecticut

Eighteen months ago this patient was examined in the office and showed early signs of essential iris atrophy which was not recognized as such. At that time the vision of each eye was 20/20 with small hyperopic correction, and her main complaint was that of burning, twitching, and tearing of both eyes and some difficulty with close work.

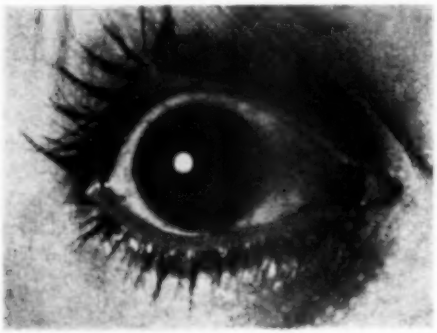

Fig. 1 (Tisher). Essential iris atrophy.

Muscle balance was normal except for convergence weakness.

The left eye showed no change, but the right eye showed a slight tucking effect in the upper nasal area. This appeared as if an injury at the limbus had caused a slight drawing up of the iris into a break in the periphery of the cornea. The patient gave no history of direct injury to the eye, but did mention that she had fallen two years before and had struck her head in the occiptal region with sufficient force to cause loss of consciousness for a short time.

There was no evidence of inflammation either outside or inside the eye. The fundus appeared to be normal. The slitlamp showed no floaters or keratic precipitates, and the iris stroma appeared perfectly normal except for the bunching, drawing up effect at about the 2-o'clock position. Routine perimeter readings were normal and tension was normal to fingers. Glasses were prescribed and the patient was asked to return in one month for reëxamination. There was some doubt concerning the diagnosis, but the findings were noted as probably being the effects of an old injury.

The patient did not return until 18 months later at which time she stated that she had had no difficulty until two months previously when she began to notice spots before the right eye and extreme photophobia. She also had occasional headaches relieved by aspirin.

The findings in the left eye were unchanged but the picture in the right eye was markedly different. Routine examination of fields and fundus showed no changes from the previous examination. The cornea was clear. Finger palpation, however, showed a hard eyeball. Tension at this time was 90 mm. Hg (MacLean). The anterior chamber was deep and the iris was displaced. The pupil was pulled up and irregular so that the lower edge was above the middle; the upper edge was at the limbus. There was a large atrophic hole in the lower portion of the iris about 2.5 mm. in diameter, with some strands, stroma remnants, extending vertically at the temporal edge of the hole. There was an almost equally large area of atrophic stroma temporally and another smaller area in the lower temporal aspect.

The stroma was also atrophic in other areas, the stroma layer being definitely more atrophic than the posterior pigment layer. At the upper limbus and also in the upper temporal aspect of the iris, the root of the iris appeared to be definitely thickened. It almost appeared as if this area in thickening and shrinking had pulled the pupil up and that the pull had caused the opposite portion of the iris to become atrophic.

Repeated doses of miotics of various strengths brought the tension down to be-

tween 50 to 60 mm. Hg (MacLean) and 28 to 32 mm. Hg (Gradle-Schiøtz). This seemed to relieve the patient of pain and ocular difficulty. Discontinuance of the medication caused immediate rise in tension and return of symptoms.

Duke-Elder describes this condition as a unilateral disease of unknown etiology, characterized by a slowly progressive atrophic change in the tissues of the iris, which leads to the complete disappearance of large portions of the tissue and ultimately ends in blindness from absolute glaucoma. He further describes it as coming on in early adult life with the development of an eccentric position of the pupil, which becomes distorted and displaced to the side. Usually the pupil shows an ectropion of the pigment epithelium and, finally, merely a shriveled remnant of the iris connects it to the ciliary body. On the opposite side, large holes appear in the iris. These enlarge and coalesce so that the entire tissue atrophies until only a few strands of stroma remain, with large apertures between. Eventually, after some years, when most of the iris vanishes, the tension rises and the first clinical symptoms become conspicious.

The glaucoma that develops shows little response to miotics and can rarely be operated with success. The common end result is blindness. As far as can be learned, all cases reported have been unilateral.

99 West Main Street.

RETINAL ANGIOSPASM*

The fundus in diffferent stages of an attack in the left eye

Ursula Rexed
Stockholm, Sweden

A number of cases of retinal angiospasm showing attacks of temporary blindness have been described in the literature (Duke-Elder: Textbook of Ophthalmology, v. 3, 1945). However, it is seldom that such attacks have been photographed. I am showing here a series of photographs of the fundus taken during an attack.

Case report

History. The patient, a business woman, aged 40 years, had often shown signs of vasolability with blushing, palpitation, and a general sensation of warmth. She had occasionally had a slight feeling of numbness in her fingers, otherwise she had had no symptoms of circulatory disturbances or endocrine trouble. Three years earlier she had had an attack of blindness of the left eye which lasted for 2 to 3 minutes and which did not recur. She had had no more attacks between this time and the time when she was observed at the clinic.

She arrived at the ophthalmic clinic one evening in October, with an acute attack of blindness of the left eye caused by retinal angiospasm. This attack lasted for a couple of minutes and was followed by a series of similar attacks in the left eye, each attack lasting for about 10 minutes. The patient was extremely nervous and agitated and showed palpitation and blushing cheeks.

The pulse rate and blood pressure showed an increase during the attacks. In one attack the pulse rate rose from 104 to 120 and the systolic blood pressure from 130 to 150 mm. Hg.

The visual acuity of the left eye was 0.8 between the attacks and diminished to perception of hand movements during an attack. In the left eye the perimetric field was being measured when an attack occurred. The field was rapidly diminished from without inwards. Between the attacks the field was normal and showed no scotomas.

The patient was given vasodil subcutaneously and by mouth and luminal tablets and put to bed. The attacks continued during the night but had practically ceased by the next morning. Only a couple of stray attacks occurred during the day, one of which was

* From the ophthalmic clinic, Karolinska Sjukhuset.

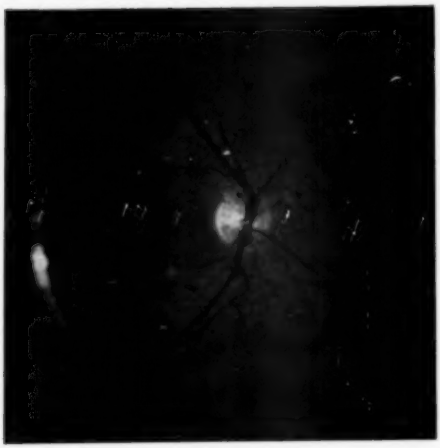

Fig. 1 (Rexed). The normal fundus of the right eye.

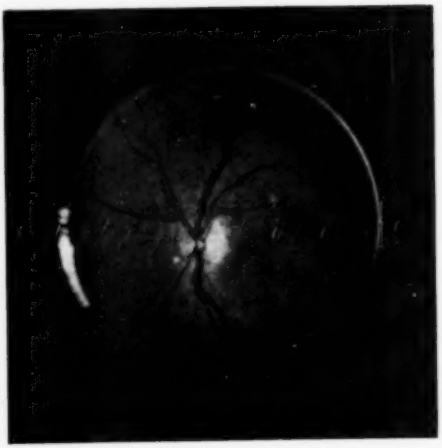

Fig. 2 (Rexed). The normal fundus of the left eye.

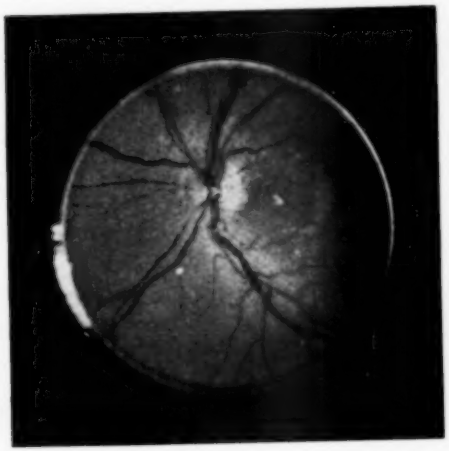

Fig. 3 (Rexed). Fundus of the left eye taken between attacks of retinal angiospasm, three hours after a preceding attack and about 10 minutes before the photographs (figs. 4 to 8) of different stages of an attack.

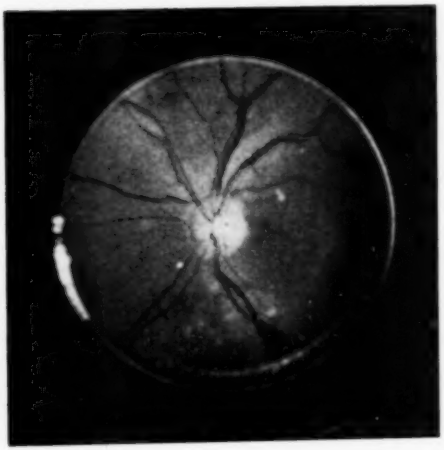

Fig. 4 (Rexed). Fundus of the left eye during an attack of retinal angiospasm taken about one minute after the attack had started. The arteries have contracted, several of the smaller arteries can no longer be seen (the small artery at the 9-o'clock position and the smaller arteries between the 3- to 6-o'clock positions). The veins have also contracted and the color of the fundus is paler than in Figure 3.

the one photographed. After this, no more attacks occurred, although the patient stayed at the clinic for over a week.

A thorough general examination was made of the patient with a view to finding the etiology of the attacks. The electrocardiogram showed a sinus tachycardia with a rate of 120. The arteries of the legs and feet were examined by oscillometry, and the skin temperature was recorded after vasodilatation. The results seemed to show a certain lability of the arterial tonus.

All other investigations were negative. Heart and lungs were normal. Neurologic examination was normal. Gynecologic exam-

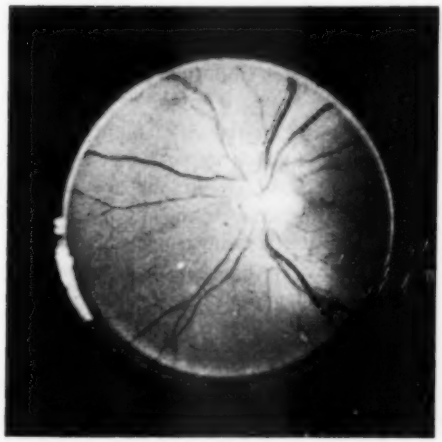

Fig. 5 (Rexed). The arteries are now extremely narrow and this is seen especially upward in the picture. There is a segmentation of the blood column in some of the veins. The color of the fundus has become still paler. (Taken 15 to 20 seconds after Figure 4.)

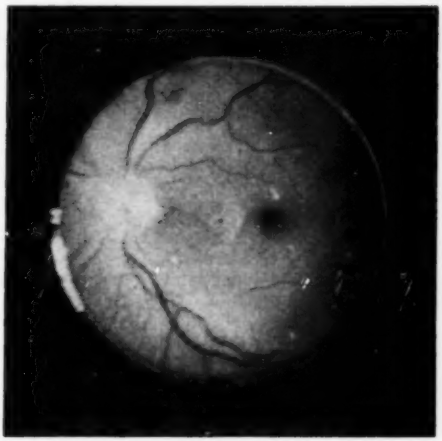

Fig. 6 (Rexed). A different part of the fundus, showing the macula. On the optic disc the arteries are seen to be empty. This was a phenomenon that occurred toward the end of each attack as the spasm reached its maximum, and which was followed by a sudden filling up of the vessels, as seen in Figure 7. A slight cherry-red contrast is seen in the macula. Ophthalmoscopically, a slight edema was observed. (15 to 20 seconds after Figure 5.)

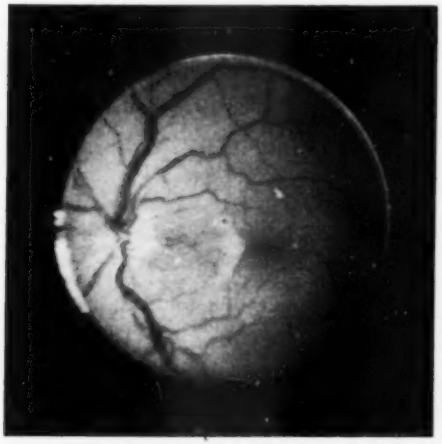

Fig. 7 (Rexed). In this view, most of the vessels have filled up. Some of the arteries are, however, still empty and are seen near the disc as thin white lines. The veins are engorged. The fundus has started to regain its color, especially in the periphery. (15 to 20 seconds after Figure 6.)

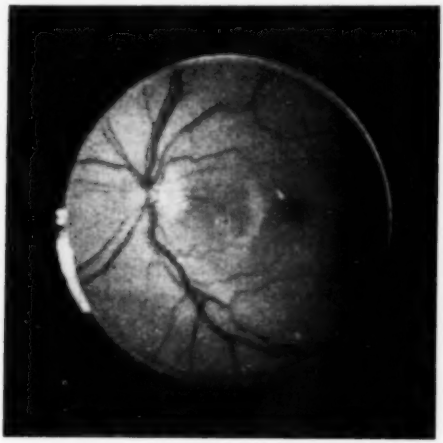

Fig. 8 (Rexed). All of the arteries are now filled up. The veins are still engorged. The fundus is redder. (15 to 20 seconds after Figure 7.)

ination was normal; the patient had never had any disturbances of menstruation. The basal metabolism rate was a plus 11. An electroretinogram, taken between the attacks, gave normal findings. It was not possible to provoke an attack during the registration.

Banèrgatan 33[4].

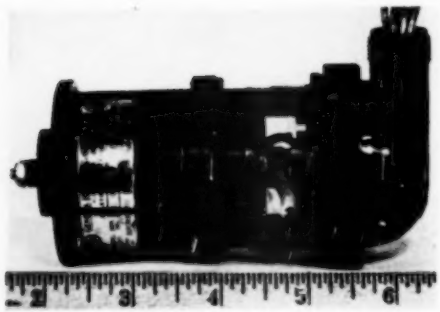

Fig. 1 (Weston). Motor used for the electrical control of revolving astigmatic cross.

AN ELECTRICAL REMOTE CONTROL FOR THE REVOLVING ASTIGMATIC CROSS

HORACE L. WESTON, M.D.
Detroit, Michigan

The revolving astigmatic cross has been recognized for years as a useful aid in the measurement of ocular astigmatism, particularly with regard to the strength of the correcting cylinder. However, since the cross is of little value unless it can be turned to the appropriate axis for each eye, it has been necessary to devise remote controls in order to eliminate the inconvenience of direct hand adjustment.

Remote control has usually been achieved by the use of strings and weights or by the use of a gear box and reversing motor. The former method accomplishes the purpose well but frequently necessitates the use of unsightly strings. The latter method is more modern in appearance but too slow in operation.

For the past year, I have been using an electrical remote control which is practically instantaneous in action and is accurate to within one degree. The astigmatic cross which is mounted near the Snellen test chart is synchronized with the dial on the control box by the use of a pair of selsyn generators. These "generators" or "motors" were obtained from war-surplus stock (frequently advertised in popular science and radio magazines). The motors in use (fig. 1) were designed to operate on 115 volt-400 cycle A.C. but work well on 24 volt-60 cycle A.C., as obtained from an ordinary furnace control transformer.

The control unit (fig. 2) is mounted in a box on top of which are push-button switches for the primary circuit and for a muscle light. The primary circuit is turned on only when the dial is being rotated, in order to eliminate hum. An 8-wire radio battery cable leads from the control box to the chart box.

In present operation, reverse charts are employed for use with a mirror. For operation at 20 feet one needs only to use a longer cable and to reverse two of the control wires so that the generators will turn in opposite directions. The driving generator and the muscle-light mounting are located behind the face of the box. Storage space for other charts is located in the upper half and is reached through a slot in the side.

In addition to affording an excellent test object for the finer measurement of cylinder strength the single-line cross is useful when used in connection with the cross-cylinder in the highly sensitive axis test reported by Crisp and Stine.* To facilitate this test small marks have been added to the control dial at the 45° and 135° positions.

703 Stroh Building (26).

* Crisp, W. H., and Stine, G. T.: A further, very delicate test for astigmatic axis, using the cross cylinder with an astigmatic dial and without use of letter charts. Am. J. Ophth., **32**:1065 (Aug.) 1949.

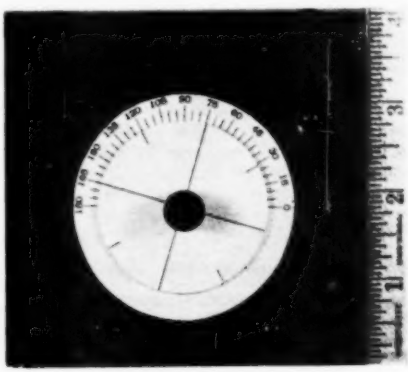

Fig. 2 (Weston). The control unit.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

October 21, 1948

DR. PERCE DELONG, *chairman*

OPTOCHIASMATIC ARACHNOIDITIS

DR. MORGAN B. RAIFORD (by invitation) presented an 8-year-old white boy, who was admitted to the Graduate Hospital of the University of Pennsylvania on June 15, 1948.

The chief complaint was that of poor vision in both eyes which was first noted in December, 1947. He had no history of any intercurrent disease, either ophthalmic or systematic other than a fall in October, 1947, which resulted in a contusion of the forehead without any noticeable effects.

When returning to school after the Christmas vacation, he noticed that he was unable to see the blackboard. There was no pain or redness or any other symptom. He was hospitalized from the middle of February to mid-April, 1948. The diagnosis at that time was optic neuritis. He had had spinal-fluid examinations, six typhoid injections, and multiple vitamins. These studies were repeated in another hospital and confirmed. The patient's visual defect gradually increased, however, up to the time of hospitalization (mother's statement) of June of this year. The parents have been in excellent health, and the boy's one sisiter, is normal.

Systemic review. Tonsils had been removed at five years of age. The patient had complained of transitory frontal headaches that were noticeable by his mother in November and December, 1947. They were dull and diffuse in character. He had suffered with no headaches since that period.

Neck, negative; heart and lungs, negative; appetite good, abdomen and bowel function normal—no history of nausea or vomiting; genito-urinary system, negative; extremities, negative; skin, negative. The patient had no physical abnormalities other than the ocular defects.

Eye examination. There was no exophthalmos, ptosis, nor nystagmus. Pupils were round, central, reacted equally to light and accommodation, and consensually. Tension was: O.D., 17 mm. Hg (Schiøtz); O.S. 19 mm. Hg. Extraocular movements were normal and full. Lids and lacrimal apparatus were normal. Vision was: O.D., 2/60; O.S., 2/60.

Refraction under atropine cycloplegia on June 17, 1948, was: O.D., +0.5D. sph. = 2/60; pinhole, 2/60. O.S., +0.5D. sph. = 2/60; pinhole, 2/60. The patient complained of his vision being smoky.

Visual fields on June 18, 1948, showed concentric contraction of both the peripheral and central fields with slight enlargement of the blind spots. No scotoma was present. Could not see less than 5-mm. white test object clearly. Sclera and cornea were normal; lenses were clear and normal; vitreous was clear.

Fundus examination showed that the discs were pale and both outlines were hazy. A binocular ophthalmoscopic examination was done, and no evidence was present that suggested old papilledema. The blood vessels were normal with an arteriovenous ratio of 2 to 3. The macular areas revealed slight pigmentation. The periphery were clear. No hemorrhages or exudates were present.

A neurologic examination by Dr. Joseph Yaskin did not reveal any other abnormalities.

On June 18, 1948, X-ray studies of the skull, orbits, sella, and optic foramina were negative.

A ventriculo-encephalogram was done June 29, 1948, by Dr. Finkelstein and the following reported: "Only a small portion of the third ventricle is visualized and this is normal in size. The fourth ventricle is not

visualized. No air can be seen in the basal cisterna or the subarachnoid pathways. We are, therefore, unable to exclude the presence of a posterior fossa lesion, such as a tumor or basal arachnoiditis."

Operation. In veiw of these findings, a right frontoparietal craniotomy was done by Dr. Robert A. Groff on July 6, 1948, and a chronic arachnoiditis was found around the optic nerves and chiasm. These fibrous bands and adhesions were incised and the optic nerve freed.

The patient made an uneventful recovery, and was discharged on July 13, 1948.

The patient was last seen on September 15, 1948, at which time the visual acuity was: O.D., 6/30; O.S., 6/7.5. The visual improvement has been quite noticeable to the patient, and he has been able to read without any difficulty.

Discussion. Dr. Robert A. Groff: There is one contribution I should like to make, and that is that there are other cases which have been verified by operation. However, I do not believe there are any so young verified by operation in the literature. Arachnoiditis is a definite entity. It occurs primarily around and near the chiasm, and secondly about the cisterna magna in the posterior fossa, in both instances frequently simulating tumor. This is in the literature, and was referred to by Dr. Frazier as pseudotumor.

The diagnosis is extremely difficult and, to me, is only made at the operating table. I do not believe that the diagnosis can be made clinically with certainty, but it can be suspected, and then confirmed at operation. It is very difficult to make a decision to operate on such an individual, because the operation is rather serious. However, one weighs that against the fact that vision is extremely important to the patient. The entire matter has to be put before the family with the idea that we may be able to do something for the vision of the patient or not, depending on what we find. In this patient we were very fortunate in finding a definitely thickened arachnoid, which was removed from the region of the chiasm. The subsequent course showed that the arachnoiditis had been the cause of the visual effect.

Secondary Functions of Inferior Oblique

Dr. William E. Krewson, III, briefly reviewed the literature with its confusion regarding the manner in which the inferior oblique muscle moves the eye. Perspective drawings portraying the muscle plane and the location of the muscle were shown for various positions of rotation.

The action generally attributed to the inferior oblique muscle is primarily that of extortion, which increases as the eye is externally rotated, together with the secondary or subsidiary functions of elevation, which increases as the eye is turned inward, and external rotation, which increases as the eye is rotated outward. Based on the anatomic data of Volkmann, variations in these generally accepted actions apparently exist.

Both the primary function of extortion and the subsidiary action of elevation can be shown to have their maximum effect when the eye is turned outward seven degrees, while at this position the horizontal rotating effect is nonexistent. As the eye is turned outward beyond this position, the inferior oblique muscle becomes an external rotator and, as the eye is turned inward from this position, the muscle acts as an internal rotator.

The manner in which the muscle actually functions depends upon its angular attachment to the globe. Probably these opposing views can be reconciled on the basis of the marked variation which is known to exist in the anatomy of the extraocular muscles.

Discussion. Dr. Francis Heed Adler: This careful study by Dr. Krewson is about the best argument we have for abandoning the old conception of a primary, secondary, and tertiary action of each of the ocular muscles. This may have been a convenient way of teaching the various components of

pull of each of the muscles, but it leads to false conceptions.

These studies show that the inferior oblique has one action in one position of gaze, and in another position a diametrically opposite action. The same is true, not only of the inferior oblique, but of the superior oblique and both the superior and inferior recti. We think of the superior rectus as an adductor, and it is, in the primary position of gaze, but, when the eyeball is abducted 23 degrees from the primary position, it loses its adduction as one of the components of its pull, and, when the eye is rotated outward beyond that point, it then becomes an abductor.

I think we must accept the studies that have been made which show that there is no center of rotation of the globe. The studies of Park and Park and of Verrijp and others have proved conclusively that we do not have such ideal conditions as a point center of rotation about which the eye moves.

The eye makes transitory movements laterally, forward and backward, and up and down, and the centers of rotation cover an area of some few millimeters. For this reason, it is extremely difficult to make calculations which decide in just what position the inferior oblique becomes an adductor instead of an abductor.

There is a point in muscle physiology, which is often overlooked, and that is that in all ocular movements, more than one muscle is contracted. In the lateral versions, for example, five muscles are co-contracting in each eye simultaneously. In dextro-version, the lateral rectus of the right eye acts sufficiently as an abductor at the start. In this position it has a long arc of contact, and is working at a mechanical advantage. The superior and inferior recti in this position co-contract, and keep the eyeball from moving up or down. They also act as adductors in this position, but this adduction is balanced by the co-contraction of the two obliques which keep the vertical meridian erect and by their abducting effect counterbalance the adducting effect of the superior and inferior recti. As the movement progresses, the lateral rectus acts to a greater and greater disadvantage.

When the eyeball has passed 23-degrees abduction, the superior and inferior recti become abductors, and they, together with the obliques, are largely responsible for the further abduction of the eye. This fact explains the modus operandi of the Hummelsheim operation, and probably all operations which are modifications of this. By transplanting part of the superior and inferior recti to the attachment of the lateral rectus, we make these muscles abductors by their co-contraction, and this abduction takes effect at the very beginning of dextro-version.

These studies by Dr. Krewson are of vital interest, and should eradicate from textbooks the idea that each ocular muscle has three separate functions.

Dr. Krewson, (closing): I want to thank Dr. Adler for his informative discussion. His criticisms are well taken, and quite justified. It is true that there is no fixed center of rotation, and that this center is not identical with the anatomic or geometric center of the globe. Also, variations due to the check-ligaments, Tenon's capsule, and the like are factors, but probably none greatly affect the overall picture.

It is also true, as I intended to mention but omitted because of limited time (but will include in published manuscript), that no one muscle acts on the globe independently or at any one time. I did not wish to imply that the muscle, the inferior oblique in this case, actually and independently turned the eye to the positions indicated; rather, the analysis is to show how the energy of the muscle is expended on the globe, or how the muscle really acts, when the eye is already rotated in the various positions mentioned.

Syphilitic primary optic atrophy

Dr. Joseph V. Klauder, Dr. George P. Meyer, and Dr. Benjamin A. Gross (by invitation) gave a brief resume of the reports on the frequency of syphilis as a cause of blindness. They said that 10 to 15 percent

of blindness is due to syphilis. The importance of this in the United States is shown by the fact that there are between 20,000 and 30,000 cases of blindness due mainly to syphilitic optic atrophy.

A report was presented on the study of 397 cases of syphilitic primary optic atrophy, 20 of which were of congenital syphilitic origin, the remainder acquired. The authors discussed (1) Relationship of age, sex, race, and type of disease; (2) character of antisyphilitic therapy before onset of optic atrophy (treatment was shown to be deplorably inadequate); (3) visual acuity, time of admission to clinic (61 percent were industrially blind or worse); (4) pathogenesis —generally accepted view is the inflammatory origin; (5) symptomatology—stress was laid upon diplopia and leg pains as prodromal, and loss of vision and field changes as early symptoms, accompanying neurosyphilitic signs are also present; (6) diagnosis—probably the earliest sign is a field defect, loss of central acuity and pallor of disc usually occur later and indicate further advanced and usually irrevocable changes.

The authors' comments were: (1) Syphilis is a very frequent cause of blindness, approaching cataract and glaucoma in importance; (2) ophthalmologists are urged to be alert to the early diagnosis of this condition, for early diagnosis holds the only promise of amelioration or arrest.

Discussion. Dr. Joseph V. Klauder: In addition to the rather pessimistic figures presented by Dr. Meyer in the forepart of his presentation, one could make rather similar deductions from the following. Before the war, the incidence of new cases of syphilis in the United States as calculated by the U.S. Public Health Service was about one-half million per year. That decreased until shortly after the war it slightly increased, and it is estimated now that there are about one-fourth million new cases of syphilis arising each year. It is thought that, of new cases of syphilis, about 5 percent, if untreated or inadequately treated, will later develop tabes dorsalis; of these patients, 10 to 15 percent will develop optic atrophy. This estimation applies only to patients with tabes dorsalis, and does not apply to about 40 percent of patients with optic atrophy associated with neurosyphilis other than the tabetic form.

Dr. Meyer has presented our rather unfortunate experience in early diagnosis of optic atrophy at Wills Hospital. The figures he presented—61 percent of patients when first seen were industrially blind—are certainly not gratifying.

What can we do about it? I think the importance of syphilis as a cause of blindness needs no emphasis. It is worthy of attention of every physician who treats syphilis. The ophthalmologist is particularly concerned in syphilis as a cause of blindness. We appeal to ophthalmologists for more interest in syphilis as a systemic disease, in its public health aspects, its treatment, and in the early diagnosis of optic atrophy. We believe that was the implication in Berens and Goldberg's report (Syphilis in relation to the prevention of blindness: A study of 100,000 case records. J.A.M.A., **109**:777-781 (Sept.) 1937) in which it was stated that frequently insufficient attention was given to the history, examination, serologic tests, and treatment of patients whose ocular disease was syphilitic in origin.

Optic atrophy occurs in patients whose neurosyphilis usually pursues a silent form. It is infrequently associated with the classical symptoms of tabes dorsalis—dysuria, ataxia, and severe leg pains. In our study the two most frequent symptoms preceding subjective loss of vision were diplopia and leg pains. Diplopia was usually transitory and preceded, frequently by years, loss of vision. Leg pains were usually mild and elicited only by direct questioning. Optic atrophy predominantly occurs in patients who are unacquainted with their infection and who have had no antisyphilitic treatment. Unfortunately, the major symptom that leads to diagnosis is impaired vision.

Ten years, at least, elapses after infection

for optic atrophy to develop, the usual interval is 18 years. There must be a period in which early perimetric field defects are present preceding pallor of the nervehead and impairment of visual acuity. From our study, we believe that that period may range from a few months to several years. We would stress that interval as a propitious one for early diagnosis of optic atrophy. To accomplish this, routine ophthalmoscopic examination is necessary on every patient with syphilis of more than 10 years' duration, certainly on every patient with neurosyphilis. It is to be recalled that pupillary abnormalities are common symptoms of neurosyphilis, appearing early and constituting "short cut" in clinical diagnosis.

Bruetsch observed basilar meningitis as part of optic atrophy existing in the absence of other evidence of neurosyphilis. Clinical diagnosis of syphilitic optic atrophy is, therefore, justified in a syphilitic patient without evidence of neurosyphilis. In our experience, however, this occurrence is rare.

To facilitate early diagnosis of optic atrophy, ophthalmologists and all physicians who examine patients with syphilis should have a high degree of awareness of the optic nerve. In records of private, ward, and clinic patients, too infrequently no mention is made of examination of the optic nerve unless the patient complained of visual loss. The ophthalmologists are admirably situated to exclude optic atrophy in every patient examined, who has had syphilis of some years' duration, at least in patients with pupillary abnormalities.

The ophthalmoscope and the perimeter should be added to the lists of instruments—dark field microscope, lumbar-puncture needle, roentgen ray, and electrocardiograph—of vital importance in the diagnosis of syphilis.

Dr. Louis Lehrfeld. In the year 1937, there was prepared from data at the Wills Hospital a survey on optic atrophy due to syphilis. This survey covered a period of years, 1926 to 1937 inclusive. There was a total of 522 patients studied. All of these patients had some degree of optic atrophy. It is gratifying indeed to find that the present investigators have found statistics that are quite comparable with those that were reported by me in 1937. That survey aimed to find out what happened to patients with optic atrophy. Did they get well? Did they get worse? And was our treatment effective in controlling optic atrophy?

I am reminded in reading Duke-Elder tonight of the statistics in which he quotes me: "Of the untreated cases, 74 percent were blinded in a period of three years; all of them were blind in five years. Of those treated by the well-known methods of antiluetic treatment at the time, 24 percent of the optic-atrophy cases became blind in a period of five years, and all of them were blind in a period of eight years."

This was very damaging evidence, pointing out that the method of treatment at the time was not sufficient to control optic atrophy due to syphilis, to cure it, or even to arrest it. I had hoped that the essayists tonight would give us some information along those lines. Despite the fact that we preach early diagnosis of optic atrophy, it is true that our methods of treatment today are insufficient and inadequate. What suggestions do the essayists have in the way of modifying our methods of today to bring about a control of optic atrophy, or at least to reduce the incidence of blindness from this disease?

I wish to call your attention to an article published in *Science* of November 7, 1947, by Dr. Knisley of Chicago. In that article he speaks of blood sludging occurring in various diseases. He speaks of the red cells in the blood becoming sticky, and agglutinating in malaria and various inflammatory and infectious diseases. Dr. Knisley has probably opened up an entirely new field of pathology in the case of optic atrophy due to syphilis, namely the blood sludging occurring in the end arteries of the retina. Sludging means that the blood vessel caliber is

closed, the nutrition of the part ceases, and progressive optic atrophy develops. The question I wish to point out to the investigators tonight is this. Do we have anything to control optic atrophy even if it is diagnosed early? Are the methods used today—the use of penicillin, the use of heavy metals—sufficient to control optic atrophy, or are we going to lean upon Dr. Knisley for another suggestion so as to prevent blood sludging, and thereby prevent optic atrophy?

I wish to congratulate the authors of the article just presented, and I know they have some very valuable information for us in rebuttal.

Dr. Joseph V. Klauder (closing): One cannot answer Dr. Lehrfeld in an arbitrary manner, because there is so much variability in the course of syphilitic atrophy. We are all familiar with the rapidly progressive cases that pursue a downhill course regardless of treatment, and are blind in one year or less. In the slowly progressive cases, the prognosis is more favorable. If we exclude the rapidly progressive cases, we do not believe the inevitable result is blindness. We have a number of patients in the clinic whose optic atrophy has remained stationary for periods of observation ranging up to 18 years. We observed this in patients who had received different methods of treatment.

Certainly one is justified in being less pessimistic about prognosis than years ago; that era, for example, when the disease was treated with strychnine. There has been considerable addition to the therapeusis of the disease. Fever therapy, especially malaria, is to be stressed. The status of penicillin awaits evaluation.

Dr. George P. Meyer (closing): If you read the program, it says, "Syphilitic primary optic atrophy as a cause of blindness and importance of early diagnosis." I think we have shown tonight the importance of early diagnosis, because with a well-advanced optic atrophy the outlook is pretty poor. I remember when Dr. Lehrfeld's article came out in 1938 I felt depressed about it. I happened to have at that time a patient who had neurosyphilis and beginning optic atrophy, and I went to one of the local syphilologists in Jersey, and asked him to undertake the treatment of syphilis. He just shrugged his shoulders, and said, "Oh well they all go blind anyway," and he was associated with one of our larger teaching institutions in the city.

The patient was subsequently referred to Dr. Klauder, and he still has vision. Dr. Klauder did not have the pessimistic outlook as far as therapy was concerned. I think the first bright note was struck by the Baltimore investigators. I do not remember the figures exactly, but there is a direct ratio between the good prognosis and the amount of vision that was retained when a patient first reported for treatment. If a patient first reported for treatment industrially blind, the outlook was pretty poor. So it is you get figures like those of Dr. Lehrfeld and Duke-Elder who report that, within eight years, all patients become blind. That certainly is not the experience in our clinic for there are many patients who still have useful vision 8 or 10 years after the diagnosis of optic atrophy was made, and I think the first person to whom we have to point that lesson is the pessimistic ophthalmologist. Get him to feel that if he is alert enough to make an early diagnosis, very valuable vision may be saved for a patient.

M. Luther Kauffman,
Clerk.

CHICAGO OPHTHALMOLOGICAL SOCIETY

October 18, 1948

Dr. Arlington C. Krause, *president*

Clinical cases were presented by the Department of Ophthalmology, Veterans Administration Hospital, Hines, Illinois.

Disciform degeneration of macula

R. D., a 29-year-old white man, entered

Hines Hospital on February 26, 1948, complaining of defective vision in both eyes for six months. He stated that on routine examination overseas in October, 1943, vision was: R.E., 20/40; L.E., 20/20. He had no complaint at that time. He received a medical discharge from the Army in 1943 because of rheumatic fever. In August, 1947, he was seen by an ophthalmologist who noted vision to be: R.E., 20/400; L.E., 20/70. He gave a past history of two attacks of bronchitis and one of probable rheumatoid arthritis.

When examined, his general physical condition was normal. Vision was: R.E., 20/300. Anterior segment, media, and lens were normal. Fundus showed a slightly elevated, sievelike, spongy gray mass, well circumscribed, oval in shape, occupying the macular area and containing red pinpoint spots; lateral to this was a small similar gray patch. Disc and vessels appeared normal.

Vision was: L.E., 20/30−2, correctible to 20/30+3. Anterior segment and media were normal. The lens showed a thin opacity of posterior lens capsule. The fundus revealed a mass in the macular area similar to that in the right eye, with a few small patches laterally. Within the large porous mass was a central red spot which suggested remaining normal macula.

Peripheral fields were normal; central field, right eye, showed a central scotoma surrounding the upper half of the fixation area for a distance of 5 degrees, including the fixation point. The left eye showed a pericentral doughnut-shaped scotoma circumscribing the fixation point and leaving 1 to 2 degrees free at the fixation point.

All laboratory tests revealed normal findings. A tentative diagnosis of disciform degeneration of the macula, bilateral, was made. Treatment consisted of nitrosclerin, vitamin-B complex, and thiamin.

The patient was discharged on March 19, 1948, but returned 10 days later because of sudden decrease in vision in the left eye. The lesion appeared to be the same as on previous admission except that the small area in the center of the macular area, which previously suggested normal retinal tissue, now appeared pale and degenerated. Vision was: L.E., 20/200.

Stereocampimeter showed definite central scotomas involving the fixation area bilaterally. He was given typhoid and nitrosclerin intravenously, as well as rutin and vitamin-B complex. Twenty-four days later the vision returned to 20/30+3, 5 point. He was discharged a few days later, and now returns with vision: R.E., 20/400; L.E., 20/300.

Final diagnosis: Disciform degeneration of the macula, bilateral.

Disciform macular degeneration

J. E. A., a 32-year-old white man entered Hines Hospital on April 10, 1948, complaining of a small blind area in the right eye of two weeks' duration. The scotoma was located just below the fixation object and moved in the same direction as the eye. In 1943, he suffered loss of central vision in the left eye over a six months' period; there was no associated pain. He received a medical discharge in 1945. Past general history was negative except for an abscess in an upper incisor tooth.

General physical examination was normal except for an atrophic testis on the right side.

Examination of the eyes showed: R.E., vision 20/20, anterior segment, media, lens, normal; fundus showed a normal disc but the macular area appeared edematous and contained 4 or 5 hemorrhagic spots, mostly deep and round, and one superficial flame-shaped hemorrhage. A small dot of exudate was present.

L.E., vision, large objects only, not correctible; anterior segment, media, and lens normal.

The fundus revealed a normal disc, but temporal to the disc and overlying the macula was a white circumscribed elevated fibrous mass, about 3 disc diameters across. The

retinal vessels rose about 2 diopters to cross over it. The mass was fairly round but had a pseudopod in the upper aspect, and contained a slight amount of pigment. Temporal to the mass was a small circumscribed pigment patch. The retina was pale, suggesting change of a glial nature. The central field, right eye, showed a round scotoma about 10 degrees in diameter, situated just below the fixation point.

All laboratory tests and X-ray findings were within normal limits. Genito-urinary examination showed a mild chronic prostatitis, which improved under treatment. Dental examination revealed evidence of pyorrhea and three teeth were extracted.

The patient was put on rutin and thiamin therapy and one small injection of typhoid, intravenously.

Shortly after admission, more small hemorrhages together with waxy edema of the right macula became apparent. Vision decreased rapidly; on May 10th, it was 20/100 and the scotoma included the fixation point. There was a suggestion of a macular star. About 4 disc diameters from the disc at the 7-o'clock position was a small round gray exudate. Another oval gray patch of choroiditis was seen at the 1-o'clock position.

On May 17th, a small, round, blue exudate appeared 2 disc diameters from the disc at the 10-o'clock position. On May 18th, vision in the right eye improved to 20/70, and the scotoma appeared to be smaller. However, the vision continued to fall and by June 1st, it was 20/400; today it is 5/400, not correctible.

Final diagnosis: (1) Disciform degeneration of macula, bilateral, progressive on right, unchanged on left; (2) prostatitis, chronic, mild, improved.

IRIDOCYCLITIS, CHOROIDITIS, AND GLAUCOMA

S. G., a 34-year-old white man, entered Hines Hospital on March 19, 1948, complaining of progressive blurred vision and aching in the right eye of three days' duration, together with a feeling of "pressure," slight redness, but no discharge.

In January, 1943, he noted a spiderweb appearance over the right eye which lasted for three weeks. This recurred three months later and then cleared with vision of 20/20. The left eye was normal. He had a similar episode in 1944.

In January, 1946, he entered the hospital with the same complaints. At that time eye examination showed visual acuity: R.E., 20/100; not correctible; lids, sclera and lens were normal; 1+ mixed bulbar injection; iris muddy; pupil dilated to 5 mm. under atropine; slitlamp showed 2+ aqueous flare with many cells present, numerous keratic precipitates in delta configuration in lower third of cornea; the fundus revealed a faint red reflex but no details were visible.

The left eye was normal. A diagnosis of iritis, acute, recurrent, was made and he was discharged in six weeks. Vision: R.E., 20/20−3; L.E., 20/20. The family history was essentially negative. The patient had had usual childhood diseases and malaria in 1943, with eight recurrences.

General physical examination revealed some carious teeth and was otherwise negative. Examination of eyes: R.E., atropinized, vision was 20/40−1 with pinhole; lids normal; questionable pericorneal injection. The cornea showed some endothelial bedewing in lower inner quadrant. One minute pigment particle was noted on endothelium; 1+ aqueous flare, and few cells seen. The lens revealed a clump of pigment in lower half of anterior lens capsule. Vitreous floaters were present. The fundus showed a discrete circumscribed small bluish exudate, one disc diameter from the fovea. Tactile tension was normal. Left eye, vision 20/15, essentially normal.

All laboratory and X-ray tests, including smears for malaria, were negative.

Treatment was started with atropine solution and hot, wet dressings to the right eye, and a course of typhoid injections was given. Nose and throat and genito-urinary

consultation gave no significant findings. Brucellergin skin test, Volmer patch test, and first strength P.P.D. were negative. The vitreous floaters appeared to be decreasing on the 5th day of hospitalization, and vision was: R.E., 20/25; the peripheral field was slightly constricted, the central field normal. Second strength P.P.D. was positive, and old tuberculin was started.

On April 18th, an increase in vitreous floaters was noted and the fundus was hazy. Old tuberculin was discontinued after five injections of 1:100 dilution in gradually increased doses. Vision was: R.E., 20/40 on May 1st, and decreased to 20/50−3 by May 3rd. The fundus appeared more cloudy.

One carious tooth was extracted and a slight ache developed in the right eye; the following day the tension rose to 65 mm. Hg (Schiøtz,); vision was 20/100. Retrobulbar injection and typhoid serum were given, with reduction of tension to 48 mm. Hg.

On May 11th, a paracentesis was performed. May 18th, the tension remained controlled; vision, 20/200; fundus, hazy and numerous keratic precipitates present.

On June 9th, the vessels in the fundus could be distinguished; a large yellowish-white exudate was seen in the superior nasal region, about 3 disc diameters across and about 5 disc diameters above the disc. This was suspected to be a tubercle.

On June 24th, the vision was 20/50 and the patient was dismissed for two weeks. On his return, vision was 20/30+2; tension, 26 mm. Hg (Schiøtz). The cornea was clear except for the paracentesis scar at the 7-o'clock position. The small discrete exudate area near the fovea was unchanged, as was the tubercle, and he was discharged.

Diagnoses: (1) Iridocyclitis, acute, recurrent, right eye; (2) choroiditis, acute, right eye, on tuberculous basis; (3) glaucoma, secondary to uveitis, right eye.

Familial corneal dystrophy

R. R. L., a man, aged 51 years, complained of progressive loss of vision since 1933; inability to wear glasses for more than a few minutes for near; intermittent redness of eyes and discharge in morning.

Eye examination was recommended when the patient was in third grade in school, but was not obtained. Repeated eye examinations since the age of 21 years revealed diminished vision. He was inducted into the Marine Corps, but not given target practice. He had had intermittent attacks of bilateral conjunctivitis, which improved with argyrol and warm boric-acid soaks. Corneal opacities were diagnosed in 1933 and glasses were prescribed, but the patient preferred 5- and 10-cent store reading glasses.

Family history revealed that his father died at the age of 61 years of a stroke. There was a history of special eye examinations. His mother died at the age of 67 years of diabetes. One eye had been enucleated; vision was poor with glasses. Four brothers had good vision. One brother had had one eye enucleated (traumatic). The other eye has "lattice-type dystrophy," and this man has been a patient of Dr. Fitzgerald. One sister has some eye trouble.

R. R. L. was first seen at Hines Hospital in 1931, at which time he was admitted for an injury. At that time vision was O.U., 20/50 correctible to 20/30. In 1933, the vision was unchanged, although the examiner described "fine stippling opacities of the cornea with clear centers seen bilaterally with slitlamp." In 1936 and 1946, vision had deteriorated to 20/100 and 20/200 respectively. At present:

	Searchingly	P.H.	Mydriatic
O.D.	20/50	20/50	20/70
O.S.	20/30	20/30	20/70

Own Glasses

2.5D sph., 20/60
4.0D. sph. ⌒ 2.0D. cyl. ax. 180°, 20/30

Examination of both eyes showed tactile tension to be soft; pupils equal and reacted to light, directly and consensually, and to accommodation; moderate chronic injection

of palpebral conjunctiva; marked anesthesia of corneas, which grossly had appearance of glass eyes badly scratched through the central areas; lens, media, fundus, negative.

Slitlamp examinations showed both corneas to have multiple discrete and confluent gray-white lesions of varying size and shape through all layers, confined to the central 6 mm.; pupil zones relatively clearer, with fewer lesions. The lesions themselves appeared like clumpings of a snowflakelike substance, in solid nodes and complete and incomplete doughnutlike rings. The overlying epithelium was irregular and the majority of the lesions were in the superficial stroma. The periphery was not entirely clear but had what appeared to be a gerontoxin in the inferior one half.

Discussion. Dr. James E. Lebensohn said that all these patients show the juvenile type of disciform degeneration of the macula. Three very similar cases were illustrated by Adler, in 1944, and, although the senile form of disciform degeneration of the macula is more commonly seen, the first cases reported were also of the juvenile type. The abiotrophies are generally not restricted to one age level. Amaurotic family idiocy has both infantile and juvenile types. Hereditary macular degeneration can be classified by age incidence into 4 of 5 groups. There is as yet no treatment for the condition. Although temporary remissions may occur, the inevitable end is poor central vision.

Dr. Charles A. Bahn (New Orleans) felt that these cases represent the ophthalmic condition we are most frequently called upon to diagnose and treat—atypical senility. Unfortunately, few people are like the one-horse shay of Oliver Wendell Holmes; some of the billions of cells which constitute the body are dying and being reborn every minute. The constitutional death and replacement rate varies widely in different tissues in different persons, and at different periods of life. In the retinal neuro-epithelium, for example, there is practically no replacement after birth. Hence, if these cells have a constitutional predisposition to senility, function becomes permanently lost before death. If this process takes place in childhood, it is called Best's disease; in adolescence, Stargard's disease; and in middle life, Behr's disease. These are essentially the same condition, varying only at the time at which presenility actually manifests itself. The macula is usually first involved because it is phylogenically the oldest part of the retina and more highly specialized. The absence of repair is illustrated in the lack of new blood-vessel formation.

The younger ophthalmologists especially would do well to obtain a better understanding of the structural and functional evidences of normal and abnormal senility in all parts of the eye because of their diagnostic importance.

Dr. Homer Field said that the third case demonstrates the fact that, when there is posterior uveitis and glaucoma, it is hard to see what is left of the fundus. Solitary tubercles of the fundus and choroid are not too rare, neither are they common. Usually they occur in the choroid in the region of the posterior pole, or at the equator, and may be quite elevated, or under the layers of the retina and fairly flat. Sooner or later detachment occurs, which may be prominent or fairly flat. The tubercle tends to show a considerable amount of pigment. In this case, the fact that there was little disturbance of pigment is noteworthy, and it is a question whether this is a solitary tubercle or a case of posterior uveitis on a possible tuberculous basis.

The relationship between extraction of the tooth in this case and exacerbation of the condition of the eye is interesting. It demonstrates that, in differential diagnosis, one must not lose sight of more rare conditions such as Boeck-Schauman's disease which can cause considerable posterior involvement of the eye and yet does not produce too much acute inflammation. Toxoplasmosis must also be considered. In the absence of other positive findings, this could well be a solitary

tuberculous lesion; however, there are evidences of older, smaller lesions, which may or may not have been the same type. It is always interesting to think in terms of miliary tuberculosis when a solitary tubercle is found. The general condition of this patient does not speak for any great amount of tuberculous involvement.

Dr. Cyril Crane said that the fourth case was selected because it was felt that it represents a classical clinical picture of familial corneal dystrophy, first described by Grünow in 1890. It is obvious that there are many similar disease processes described under various names which are essentially the same clinical entity, probably with minor differences in morphologic detail.

Familial corneal dystrophy is an hereditary degenerative process occurring usually bilaterally, the symptoms first becoming manifest at about the age of puberty with insidious loss of vision; it is characterized by deposition of hyalinlike material in the layers of the substantia propria of the cornea, particularly the central portion thereof.

The first type described in the literature by Grünow was of this type; he later elaborated on the description by giving the histologic findings, in 1898, and, about 1917, was able to report on transmission of the disease through three generations; in 1933, he reported on four generations, all the cases having been examined by him personally.

This patient, so far as can be determined from the history, had some difficulty even prior to the age of puberty. Several cases have been reported in which it was thought that, biomicroscopically, the findings could be detected before the age of puberty. Obviously the loss of visual acuity here was so insidious that little attention was paid to it until about 1931. However, the patient was obviously otherwise physically well qualified, inasmuch as he was selected for the Marines in World War I; the qualifications for that service have always been high. He was never at any time put on the rifle range, which is an important part of the Marine Corps, so it must be assumed that at that time, when he was 19 years old, there must have been considerable loss of visual acuity.

Thirteen years later, when seen at Hines Hospital, in 1931, he showed the early slit-lamp findings of pearly white dotlike lesions occupying principally the anterior third of the substantia propria in the central area. At the present time, at the age of 51 years, the patient's visual acuity has been markedly reduced and he now has variable types of lesions in all layers of the substantia propria, some of which could be described as of the reticular variety. However, the lesions predominantly are nodular as described by Grünow, varying in size and shape, many with a rather characteristic doughnut or ringlike appearance and, for the most part, in the peripupillary zone, which is also rather characteristic.

Dr. J. Robert Fitzgerald mentioned that the younger brother of the fourth patient reported had lost one eye due to trauma many years ago. The corneal changes started some time during adult life and there was a corneal stippling similar to that seen in the older brother. The opacities were primarily in the axial portion of the cornea with a perfectly clear periphery. When last seen, about a year ago, the lesions were comet-shaped and clublike, alphabetical, and interlacing, with a rather lattice-shaped pattern in the central portion of the cornea. The opacities were much more prominent, although the visual level was apparently about the same as that of his brother. The opacities were of such density that they could be seen at 4 or 5 feet with ordinary room illumination; whereas, in this patient, they were visible primarily with retro-illumination.

Neurofibromatosis of the Eyelid

Dr. Max M. Kulvin spoke on the surgical repair of neurofibromatosis of the eyelid and reported on two cases. His paper is published in full on page 1231 of this Journal.

Discussion. Dr. James E. Lebensohn said

that, at first glance, one is discouraged from working on these cases because everything seems so disorganized. However, although the final result leaves much to be desired, it is, nevertheless, better than either the surgeon or the patient anticipated. All the patients were well satisfied with the results.

Dr. Homer G. Field stressed the use of the sliding flap with the tarsal plate in reconstruction of the eyelids. In these two cases there was marked destruction of the eyelid and, in one, there was absolutely no tarsus left—the conjunctival surface was completely obliterated. It is simple to make a tarsal conjunctival flap and slide it into position in the upper lid. The technique was designed originally by John Wheeler and later modified considerably by Wendell Hughes.

In this case the technique was actually a Wheeler-Hughes operation in reverse; instead of bringing the upper tarsal plate down to the lower lid, the lower tarsal plate was brought to the upper lid.

For overcoming ptosis any suspension procedure may be used, as a fascia lata suspension from the superior rectus; where there is so much redundant tissue, however, suspension from the brow margin is probably a better procedure.

Reconstruction of an eyelid is sometimes a problem. Where there is a large tumor mass, with complete destruction of the functioning portion of the lid, it is difficult to preserve or restore function. If ptosis is permitted to remain complete, a functioning result is not obtained.

Dr. Max M. Kulvin (closing) said that in one case the final result so far as vision is concerned is poor. Some complication developed which caused corneal scarring and not much vision was obtained, but the patient had had none for so long that he was not concerned about that.

Surgery of orbital implants

Dr. Norman Cutler (Wilmington, Delaware) discussed the ideal implant which should accomplish certain objectives such as permanence, motility, and a good cosmetic result. The integrated type implant is being improved in every respect until it now merits serious consideration by all ophthalmic surgeons. The only factor still to be determined is the one of permanence. This, of necessity, will require more than the few years so far available. The cosmetic result and motility are uniformly good. The operation has been simplified and shortened and the possibility of postoperative complications has been greatly reduced or eliminated. Although the present advances are due to the discovery and use of the plastic artificial eye, this material is still not ideal from the aspect of minimal tissue reaction.

The subject was discussed under the general headings of: (1) Types of implants—their advantages and disadvantages; (2) evisceration versus enucleation, with indications for each; (3) illustrations of operative procedures; (4) possible complications; (5) possibilities in reimplantation procedures; (6) a general discussion of statistics.

It is believed that statistics can be overemphasized in either advocating or condemning any procedure. They may be particularly misleading when constant experiment and development of a procedure is taking place and when these procedures must, in the nature of things, be carried out on human subjects.

Discussion. Dr. V. M. Leech asked whether Dr. Cutler had discarded ring implants in favor of those that have tantalum mesh only. Also, some surgeons used charred bone balls instead of glass and other smooth materials, and he wondered whether Dr. Cutler had had any experience in removing such implants in order to insert the more modern ones of which he spoke.

Dr. Cyril V. Crane asked how selection is made for reimplantation in the absence of previous history or record as to the original operative procedure, and what criteria are used to determine the presence of adequate healthy conjunctiva for reimplantation.

Dr. J. Robert Fitzgerald asked whether

Dr. Cutler had any operative technique that he feels may prevent granulomatous changes around the neck of the implant. Many times there is bleeding for a considerable period after the prosthesis has been implanted.

Dr. Norman Cutler (in closing) said that the ball and the ring implant is not being used. In his opinion, over a period of years tissue which has formed around a ring will gradually erode through. A number of his cases had been under observation for more than three years, but he felt there is a tendency, as the tissue stretches over a hard surface, for it to gradually wear thin. The principal advantage of the ring implant is that it is a space-developing implant when it turns; however, because of the difficulty of insertion it will probably not be used. He had not removed any bone balls to put in implants. One would probably have to cut the tissue off with a knife.

When a reimplant is put in, more conjunctiva is available in the fornix. The only criterion is movement in the stump. If there is no movement, there will be no improvement. Most do have quite adequate movement, but some do not.

The problem of granulomatous tissue cannot be answered as yet. He had cauterized it on occasion, but had felt that if it did occur it would not be a permanent problem.

Richard C. Gamble,
Secretary.

Ophthalmic Miniature

I have lately seen two cases in which there was a paralysis of all the parts supplied by the nerves of the third pair, viz. three of the recti muscles, one of the obliqui, and the levator palpebrae superioris, so that the upper eye-lid could not be elevated, and the globe was drawn outwards by the external straight muscle. In both instances the pupil was largely dilated. It may, perhaps, be suspected that the optic nerve was insensible; but this was not the case, for when the patient looked through a minute opening in a card, producing what may be called an artificial contracted pupil, vision was perfect. I mention these facts, because they may assist in the investigation of the subject, for further inquiry is undoubtedly necessary. If a perfect state of motion can subsist in the iris when the retina is perfectly insensible, the changes in the pupil cannot be referred to the effect of light upon the optic nerve. To what, then, it may be asked, are we to refer them? How are they to be explained? I confess that I cannot explain them.

Sir William Lawrence, *A Treatise on the Diseases of the Eye*, 1833.

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RECENT TRACHOMA STUDIES

In reviewing wartime trachoma studies for the two volumes of *Ophthalmology in the War Years,* edited by Dr. Meyer Wiener, I was impressed by the dearth of significant reports on the disease still considered by many to be the eye disease of greatest worldwide importance. Since the war, however, a number of significant studies have appeared, notably by Professor Mitsui and his collaborators in Japan and by Professor Bietti and his collaborators in Italy.

The Japanese studies were actually reported during wartime but only became available to English readers in 1948. They are summarized in an article by Professor Mitsui in this issue of the JOURNAL.

These investigators confirmed anew that human volunteers could be inoculated with trachoma. In their experience the average incubation period was from 5 to 6 days. The onset was always acute and Prowazek-Halberstaedter inclusion bodies were always present, in numbers proportionate to the severity of the clinical signs.

The question of the frequency of inclusion bodies in the chronic stage of the disease was reëxamined. Typical inclusions were

found in 537, or 65 percent, of 823 chronic cases and in 85 percent of 392 cases with typical clinical symptoms. Tissue sections were positive for inclusions in 108, or 92 percent of 117 cases. Inclusions were demonstrated in the epithelium of the lacrimal sacs of 5 of 6 patients with early conjunctival trachoma and were noted in the canaliculi of 2 additional cases.

The inclusions were never found in the subepithelial tissues and the absence of trachoma virus in these tissues was proven in 10 cases of typical trachoma: subepithelial tissue, obtained in all 10 cases without penetration of the conjunctiva, was shown to be noninfective for human volunteers; control inoculations with conjunctival tissue from the same cases resulted in typical infection. Furthermore, subconjunctival inoculation of volunteers with infective material failed to induce trachoma; whereas, a control inoculation of the conjunctiva with the same material resulted in typical experimental trachoma.

In tissue-culture experiments, the Japanese investigators were unable to obtain growth of the virus in serial cultures, although the first two cultures of trachomatous epithelium were infective. On the basis of inoculation experiments on blind infant eyes, they claim to have established an identity between inclusion blennorrhea and trachoma but their evidence on this point is inconclusive. Interestingly enough, they were able to infect the human cervix with trachomatous materials, a finding comparable to that of Braley who obtained infection of the cervix of the female baboon with trachoma virus.

The experiments of Bietti and his collaborators dealt primarily with the therapy of trachoma, although Bietti covered all aspects of the disease in a monograph entitled "Il Trachoma," published in Rome in December, 1947. In a resume of his studies on the sulfonamide and penicillin therapy of trachoma (Revue Internationale du Trachoma, **25**: 115, 1948), Bietti concluded that all the ordinary sulfonamides were active against trachoma but that he preferred paraminophenylsulfamide.

He recommended an oral dosage of 2.5 gm. daily for 10 days or longer; topical applications he found less valuable. The drug was most effective against the secreting forms of the disease and against pannus and corneal ulceration. He found that 50 percent of all cases were cured completely and that about 10 percent of the actively secreting forms and 40 percent of the chronic hyperplastic forms were resistant.

He stated that recurrences were frequent after short treatment periods and that reinfections occurred in about 5 percent of cases. He noted that about 10 percent of subjects had an intolerance to the sulfonamides but that vitamins C and B complex were useful in reducing the intolerance. He was able to show that patients on sulfonamide therapy were noninfective for monkeys and man.

Professor Bietti found that penicillin had some curative effect on trachoma but that it was less effective than the sulfonamides. He noted the disappearance of epithelial inclusions within 72 hours. The effect of penicillin on secondary infection was marked. Streptomycin also had a marked effect on secondary infection but little if any on trachoma virus itself. Tyrothricin was of no value.

Of special interest is an article by Bietti and Pasca (Boll. Soc. ital. biol. Sper., **24**:82, 1948) reporting the inefficacy in trachoma of paraminobenzoic acid, a substance which is highly reactive against the Rickettsiae. The investigators concluded that this lack of sensitivity of trachoma virus to paraminobenzoic acid, combined with its sensitivity to the sulfonamides and penicillin and its negative Weil-Felix reaction, ruled out the existence of any close relationship between trachoma virus and the Rickettsiae.

These etiologic and therapeutic studies constitute important contributions to our knowledge of this still most destructive of eye infections.

Phillips Thygeson.

CORRESPONDENCE

American Ophthalmological Society Transactions

Editor,

American Journal of Ophthalmology:

I should like to bring to your attention that the 1949 *Transactions* of the American Ophthalmological Society, published in book form, may be purchased by advance subscription.

This volume, priced at $12.00, contains the scientific papers presented at the annual meeting and the theses for membership. It may be ordered from the Editor:

Dr. Wilfred E. Fry
1930 Chestnut Street
Philadelphia 3, Pennsylvania

All orders must be received by December 1, 1949.

(Signed) Maynard C. Wheeler,
New York, New York.

Pupillary dilatation by Datura stramonium

Editor,

American Journal of Ophthalmology:

In the March, 1949, issue of the Journal, Dr. Lucian Bauman published an interesting article on "Accidental cycloplegia by Jimson weed," in which he stated that "there are only 7 reported cases of accidental cycloplegia (by Datura stramonium) in the world literature during the past 50 years; 3 in the United States, 1 in Cuba, 1 in France, and 2 in French Morocco," and lists the references.

My name is omitted, although I observed a case of accidental pupillary dilatation due to Datura stramonium and reported it in the *Santa Fe Medical Review* (Argentine Republic) in the issue for October-December, 1940, on pages 26 and 27. In this case, accidental cycloplegia occurred while the patient was washing her hair with an infusion of leaves of the Datura stramonium and unthinkingly let some of the liquid run into her eyes. Experimentally, I have produced maximum mydriasis in eyes into which I instilled a filtered infusion of leaves of this plant.

In effect, the above paragraph is what I published in the *Santa Fe Medical Review*, and I believe that this summarized reminder is of interest as a marginal note to the recent work of Dr. Bauman.

I should like to avail myself of this opportunity to advocate the exchange of medical reviews with their articles summed up in several languages so that oculists of each country can know what is published abroad.

(Signed) Francisco Páez Allende,
Santa Fé, República Argentina.

Use of water baths to promote wound healing

Editor,

American Journal of Ophthalmology:

I have found the following procedure for the management of ocular wounds to be most successful and to fulfill these aims: (1) early closure of the wound, (2) diminution of the scar, and (3) retention of the greatest amount of visual function.

After all visible debris has been removed, the wound is submerged in a water bath as warm as the patient can stand for three quarters of an hour, warm water being added to the bath from time to time to keep the temperature even. The patient is instructed to rotate his eye and to blink occasionally.

Following local anesthesia with novocain and adrenalin, a careful wound toilet is made. It is surprising how many foreign bodies not visible before the bath are visible after it. No tissue is trimmed for the parts not possessing vitality will be eliminated. Do not scrub or scrape the wound surface. If necessary, use sutures but do not complete the sewing for the sutures are to be used to guide the healing. Wound closure is attained by submerging the wound daily in a water bath. After the toilet is completed, the

wound is bandaged. The bandage is changed daily at which time the water bath is repeated.

As soon as possible after healing starts, remove the sutures and increase the number of water baths to 3 or 4 daily. As the scar contracts, the continued water baths bring hitherto invisible foreign bodies to the surface. It is surprising how quickly old and recalcitrant wounds respond to this treatment, bringing to mind the old Latin proverb: "Medicus curat, natura sanat."

Although I claim nothing new in this procedure for wound management, I believe it is well to point out that the fear of washing a fresh wound with water has no basis in fact. Bathing infected as well as sterile wounds in warm water once or more times daily for 30 to 45 minutes not only promotes healing but produces a more satisfactory closure.

In my opinion, the best first aid in an ophthalmic emergency is to submerge the wound in warm water. The wound bath is followed by careful dressing, the use of a sulfonamide powder, or penicillin, and bandaging. Secondary sutures are used only if necessary.

(Signed) Janos Majoros,
Kiskunhalas, Hungary.

BOOK REVIEWS

ELEMENTS OF GONIOSCOPY. By Archimede Busacca. São Paulo, Brazil, Rossolillo, 1945. 187 pages, 106 illustrations, 1 color plate, bibliography, and index. Price, not listed.

The appearance of this splendid textbook of gonioscopy has not hitherto been reviewed in these pages. It is worthy of special note for its author has contributed much original thought and information to the subject and was the first to bring together in book form the rich material on gonioscopy in the literature and from his own experience.

The book is written in French, but it is so well illustrated that it is not difficult to follow. After discussing at considerable length the technique of gonioscopy (Goldmann's contact lens and biomicroscopy), the anatomy of the iris angle and its appearance in gonioscopy, the author proceeds, in Part II, to describe the pathologic conditions of the angle as studied in gonioscopy. These conditions include anterior synechias, uveitis, after operations, in injuries, keratitis, adherent leukomas, dislocated lens, iris coloboma, glaucoma capsularis, and other forms of glaucoma.

Part III discusses experimental gonioscopy in iridectomized eyes under the effect of eserine or atropine. Eserine makes the ciliary bodies visible by traction; whereas, atropine retracts them.

The growing number of books on gonioscopy in English and French signifies the extent of its importance and interest to ophthalmologists. No representative ophthalmic library should pass up this excellent modern contribution to our science.

Derrick Vail.

LA GONIOSCOPIE. By Jules François. Louvain, R. Fonteyn, 1949. 220 pages, 156 illustrations of which 48 are in color, bibliography. Price, not listed.

This beautifully written, printed, and illustrated monograph represents the results of many years of study by the author. It is the second of its kind to appear in the French language, and was prepared at the request of the Belgian Society of Ophthalmology. It forms a welcome addition to the previously published volumes on the subject, notably those of Uribe Troncoso and Archimede Busacca.

The various chapters deal with the anatomy of the iris angle, the physiologic importance of the canal of Schlemm, the technique of gonioscopy, the normal gonioscopic aspect, congenital anomalies, ocular injuries, tumors, anterior synechias, uveitis, primary and secondary glaucoma, and postoperative gonioscopy.

Dr. François has arranged his material very well and the illustrations are eminently satisfactory, so that even the non-French-reading ophthalmologist will gain much important information just by leafing through the book. Those who read French will enjoy the fluent and lucid style of its author.

Derrick Vail.

TRANSACTIONS OF THE OPHTHALMOLOGICAL SOCIETY OF AUSTRALIA. Volume 7, 1947.

The president's address, by Darcy A. William, is an interesting history of ophthalmology in Australia. The medical journals are important repositories of the data on which the story is based and their histories are included in the address. The *Australian Medical Journal*, the earlier of the two major roots of the present *Medical Journal of Australia*, which is one of the best of the world's weekly journals of general medicine, was founded in 1856.

H. M. Macindoe, in an essay on "Research organization and training overseas," recounts his experiences on an extensive visit to the medical centers of Europe and America.

J. Bruce Hamilton's "Further contribution to the study of dry eyes" amplifies his earlier study of keratitis sicca, Sjögren's syndrome, and some unclassified cases. He clarifies the relations of these diseases to desiccation keratitis, mustard-gas keratitis, Plummer-Vinson syndrome, Mikulicz's disease, and iodide "mumps." He presents a follow-up study of the patients reported in 1940 and adds a further 24 cases of dry eyes.

Tostevin gives an adequate discussion of eye protection in industry and there are numerous short reports, 1 to 5 pages in length, on 15 other topics.

F. H. Haessler.

ARCHIVOS Y MEMORIAS DE LA SOCIEDAD DE OFTALMOLOGÍA DEL LITORAL (Organo oficial de la Sociedad de Oftalmología del Litoral). Rosario, Argentina, Volume 1, 1947-1948. Paper covers, 272 pages, illustrated.

The title of this volume, and of the society which it represents, furnishes a good example of linguistic idiom. Literally, or in the dictionary sense, we are dealing with the proceedings of the ophthalmological society of the coast (of Argentina). However, the actual broader significance appears to be "Ophthalmological Society of the Provinces (or outlying areas) of Argentina, the term "litoral" or "coast" being used in this greatly broadened sense.

The society's center of action is the great city of Rosario, the second largest city of the South-American republic, with a present population well over half a million, located 200 miles northwest of Buenos Aires, on the huge river Paraná, which rises not very far from Rio de Janeiro and runs 2,720 miles before reaching the sea at the estuary called La Plata.

The very progressive city of Rosario, with an important university and medical school, gave birth in 1938 to the vigorous second ophthalmological society of Argentina. That society, just now under the presidency of Enrique V. Bertotto, the vice-presidency of Arturo Reca, and the secretaryship of Juan Vila Ortiz, has already attained a membership of 67 coming from widely separated cities of the country. It has welcomed a number of foreign ophthalmologists at its periodical meetings, including two from the United States.

The present volume, the first annual volume of transactions published independently by the society, includes about 30 papers. Perhaps the most ambitious theme presented is the very painstaking effort of Bertotto to develop a machine for making mathematically photographic tracings of the anterior segment of the eye upon which to base a mold of the anterior segment in producing a contact lens. This technique he calls stereophotogrammetry.

W. H. Crisp.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Aurell, G., and Kornerup, T. **The glandular structures at the corneoscleral junction in man and swine; the so-called "Manz glands."** Acta ophth. 27:19-45, 1949.

The object of this investigation was to clarify the conflicting data on the presence and nature of the glands described first by Manz in 1859. The material for the study consisted of a large number of specimens of the limbal conjunctiva of adult and new-born swine and man, and human embryos of different ages; most of the specimens were stained in toto. As the photomicrographs show, the structures described as the glands of Manz are only solid epithelial buds or tubules, which are rudiments of the lacrimal glands present in the embryonic limbal conjunctiva of swine. Balls of epithelium in the limbal conjunctiva of swine have no secretory function. In man there are no glands of Manz nor lacrimal glands at the limbus during any period of development. The corneal epithelium at the limbus grows into the conjunctiva as thick, often branching ridges; parts of these sometimes become isolated and form solitary epithelial balls, which may simulate glands, but which are not glands histologically, and have no secretory function. They may possibly give rise to conjunctival cysts. (17 photomicrographs.)

Ray K. Daily.

Fornes Peris, E. **The corneal innervation. Clinical considerations.** Arch. Soc. oftal. hispano-am. 9:237-244, March, 1949.

The author demonstrates with photomicrographs that the classical conception of intraepithelial corneal innervation is erroneous. There is no nerve plexus in the epithelial corneal layers, and innervation stops in the basal membrane. The patient is often unconscious of a foreign body on the cornea until the subepithelial nerves become irritated; even then he notes discomfort and lacrimation but is frequently not conscious of the foreign body, and may not seek ophthalmologic help for several days. The relief of pain when a corneal erosion is epithelialized is further clinical proof. (4 photomicrographs.)

Ray K. Daily.

Kokott, W. **Functional anatomy of the choroidal membrane.** Arch. f. Ophth. **148:** 706-724, 1948.

The author studies isolated choroids of human eyes. To present their elastic framework some were digested with 4 percent potassium hydroxide. Further information was obtained by studying the directions along which the choroidal tissue splits most easily. It was found that the choroid and ciliary muscle represent an anatomic entity. The ciliary muscle serves as the tensor choroideae and helps to fill and empty the blood vessels of this membrane. Because of ganglionic cells in the choroid this mechanism, which controls the blood supply of the eye and the intraocular pressure, is to some extent autonomous. Ernst Schmerl.

Lopez Enriquez, M. **The presence of medullary fibers in the retina.** Arch. Soc. oftal. hispano-am. **9**:367-389, April, 1949.

The author describes a patient with bilateral symmetrical medullated retinal fibers. The blind spot was somewhat enlarged and dark adaptation was retarded. The author critically reviews the literature on the disappearance of myelinated nerve fibers and emphasizes that their degeneration is of the descending type. A modification of Golgi-Rio-Hortega method of staining nerve tissue is described, and the course of the oligodendrial fibers described and illustrated. It is believed, on the basis of their anatomic course, that the oligodendrial fibers of the optic nerve are myelogenic, and the myelinated fibers of the retina are the result of a congenital anomalous extension of oligodendrial fibers into the retina. (11 figures.) Ray K. Daily.

Trantas, N. G. **Biomicroscopy of the zonule in normal eyes. Biomicroscopy of the ciliary body in two cases of surgical aphakia.** Arch. d'opht. **9**:31-38, 1949.

Trantas reports on the biomicroscopic examination of the zonule in normal eyes after full dilatation of the pupil by subconjunctival injection of 1-1000 adrenalin solution and with the Koeppe-contact glass. The zonule is examined both by direct and by retro-illumination, and detailed descriptions are given of the hyaloid membrane, the posterior fibers of the zonule, and the space between the hyaloid membrane and the posterior zonule. Trantas notes that the zonules at the equator are visible, as well as some of the most anterior ones. The triangular space (canal of Hannover) between the anterior and posterior zonule fibers is often sharply defined although traversed by a variable number of fibers from the equator of the lens. The author describes the complete illumination of the zonule by retroillumination and the visualization of the ciliary processes across the iridocrystallin space. He notes the differences in the appearance of the zonule and hyaloid membrane in myopia, in iritis, and in minimal subluxation of the lens, and stresses the clinical value of these observations.

Trantas reports two cases of surgical aphakia in which he was able to examine completely the ciliary body. He used a special flat-surface contact glass. The findings in the two cases are described in detail. The fundus of the normal eye can easily be visualized biomicroscopically up to the ora serrata and, with more difficulty, anteriorly. Phillips Thygeson.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Braley, A. E. **Experimental studies of inclusion blennorrhea: isolation of a virus.** Arch. Ophth. **41**:151-171, Feb., 1949.

The virus of inclusion blennorrhea is similar to that of trachoma, lymphogranuloma venereum and psittacosis. Attempts were made to grow the virus of

inclusion blennorrhea by direct inoculation of chorioallantoic membrane, direct inoculation of yolk sac and in fluid tissue culture, all without success. Repeated blind passages through mice were carried out with the isolation of a virus which was considered as possibly the agent of inclusion blennorrhea. Mouse brain material containing this isolated agent produced a conjunctivitis in the baboon. The inclusion bodies could not, however, be recovered from the conjunctival scrapings of the baboon. Baboon eyes that had been inoculated with mouse brain material were immune to the inoculation with inclusion body scrapings. The agent from mouse brain grew well in the developing hen's eggs and could be transferred from the eggs back into the mice without difficulty. Detailed filtration, staining and neutralization tests were carried out. From these studies it was concluded that a new, unknown virus had been isolated; however, this new virus may represent a variant of the virus of inclusion blennorrhea. John C. Long.

Campbell, F. W., and Michaelson, I. C. **Blood-vessel formation in the cornea.** Brit. J. Ophth. **33**:248-255, April, 1949.

In a series of experiments it was determined that corneal lesions beyond a certain critical distance from the limbus produced no vascular response. At less than this distance a vascular area resulted which was in the form of an isosceles triangle. The vascular responses were quite constant in size with similar lesions, which suggest that a stimulating factor is released from the lesion. (4 photomicrographs.) Orwyn H. Ellis.

Foss, Bjørn. **Experimental anaphylactic iridocyclitis.** Acta path. et microbiol. Scandinav. suppl. **81**:1-127, 1949.

This study was undertaken to understand the unusual behavior of a patient with Behcet's syndrome characterized by extensive atrophy of the iris, retinal hemorrhage, ascending atrophy of the optic nerve, and relapsing hypopyon uveitis. The oral mucosa showed aphthous efflorescences and on the genitalia numerous superficial ulcers and blisters were seen. Cutaneous tests with tuberculin, trichophytin, staphylococcal vaccine, and omnadin showed a general hypersensitiveness. He was especially sensitive to staphylococcus vaccine. Intradermal injection of 1/1000 cc. of the usual staphylococcal vaccine caused a huge infiltration, sometimes with abscess formation, and always was followed by an attack of hypopyon uveitis in one to three days. Each injection was also followed by necrotic infiltration at the site of previous ones. After a series of blood transfusions the patient was free from attacks.

When 0.1 cc. of foreign serum or egg albumin is injected into the vitreous of healthy albinotic rabbits an iridocyclitis will appear after a constant incubation period. This reactive iridocyclitis is of an anaphylactic nature. Antigen is still present after the constant incubation period, and this antigen will unite with the specific antibodies of the uveal cells. This reaction is called primary anaphylactic iridocyclitis. Rabbits that have had primary anaphylactic iridocyclitis will react with a new iridocyclitis to intravenous or subcutaneous injection of a homologous antigen. Occasionally the iridocyclitis is bilateral. This iridocyclitis is designated as secondary anaphylactic iridocyclitis. It will develop within a few hours after an intravenous injection and within 24 hours after a subcutaneous injection, but no iridocyclitis will develop after an intracutaneous injection because the antigen is fixed to the cells and does not enter the circulation.

Animals that have received a general sensitization will develop a reactive iridocyclitis as an immediate result of intravenous injection of homologous antigen,

provided that the sensitization had occurred at least eight days before.

Rabbits that have had primary anaphylactic iridocyclitis of one eye will respond with a bilateral iridocyclitis 24 hours after an injection of the homologous serum into the other eye. This reaction is called sympathetic anaphylactic iridocyclitis; it does not correspond to the clinical form of sympathetic ophthalmitis.

Precipitation tests showed that the formation of antibodies following injection of 0.1 cc. of horse serum or egg albumin into the vitreous was considerably more marked than when the same amount of antigen was injected intracutaneously. The cutaneous reactions, too, revealed that intraocular injection of the same amount of antigen sensitizes the animal to a greater degree than cutaneous or intravenous injections. After primary anaphylactic iridocyclitis animals constantly develop local anaphylactic reactions as a result of intracutaneous injection. Even the 1 to 1000 antigen dilution caused a large infiltration with a central area of hemorrhages and necroses. The subcutaneous tissue, too, presented hemorrhages and dilated, blood filled vessels.

R. Grunfeld.

Scuderi, Giuseppe. **More about hemorrhagic allergy and the eye (experimental attempts to inhibit the Sanarelli-Schwartzman phenomenon).** Ann. di ottal. e clin. ocul. **74**:512-522, Sept., 1948.

The Sanarelli-Schwartzman phenomenon is a necrotico-hemorrhagic reaction occurring when a bacterial filtrate is injected intravenously in a previously sensitized animal. Experimenting with rabbits, Scuderi found that the phenomenon could be inhibited by artificially induced fever but not by injections of antistin (a synthetic antihistamine compound). The antiallergic effect of pyrexia cannot be due to an antihistaminic action, and histamine is not a determining factor in the production of the Sanarelli-Schwartzman phenomenon. (References.)

Harry K. Messenger.

Streiff, E. B., and Cuendet, J. F. **The seasons and certain ocular affections.** Ann. d'ocul. **182**:329-363, May, 1949.

Seasonal changes of temperature, moisture, and air pressure directly influence disease. Although geographic factors influence many eye diseases, the affect of season is apparently more important in numerous ocular diseases than the literature suggests. Data on the 20,000 cases used in this survey were collected from Germany, the United States, Switzerland, Italy, Russia, China and Japan.

Chas. A. Bahn.

Suurkula, Juri. **The effect of weather on some ophthalmological diseases.** Acta ophth. **27**:75-88, 1949.

This study of 469 case histories and a critical review of the literature lead to the conclusion that the effect of air front changes on the occurrence of disease has been greatly exaggerated, and that the data on which the former studies of meteorotropism were made were incomplete and inadequate. (6 graphs, 2 tables.)

Ray K. Daily.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Bonavolontá, G., and de Bernardis, E. **Effects of Filatov's tissue therapy on experimental retinal pigment degeneration in the rabbit.** Bol. d'ocul. **28**:65-76, Feb., 1949.

Retinal pigment degeneration was produced in rabbits by intravenous injections of one cc. of 4.5-percent solution of sodium iodide per kilogram of body weight. Tissure therapy consisted of implantation of placenta according to the Filatov method and injections of palcental extracts and of

cod liver oil. The development of experimental retinal degeneration was inhibited in animals treated with both cod liver oil and placenta transplantation. Histologic examination confirmed the clinical observation. Controls treated with organ lysates of liver and of embryonic tissue did not respond with inhibition of the degenerative process in the retina. The mode of action of the effective materials is discussed. (References.)

K. W. Ascher.

Cibis, P., and Hochgeschurz, G. **Pressure experiments dealing with the effects of ischemia upon the retinal function.** Arch. f. Ophth. **148**:752-760, 1948.

The authors used H. K. Mueller's dynamometer to produce increased intraocular pressure in man and studied visual acuity and visual fields in relation to the diastolic and systolic bloodpressure. They conclude that the diminished efficiency of the eye in diseases which have increased tension is caused by circulatory disturbances, not by primary changes of the optic nerve.

Ernst Schmerl.

Cruthirds, A. E. **Sulfur metabolism and its relation to wound healing in ophthalmology and otolaryngology.** Tr. Am. Acad. Ophth. pp. 596-604, May-June, 1949.

In the treatment of many types of acid and alkaline burns of the eyes a 5-percent solution of hydrosulfosol in castor oil is recommended. Hydrosulfosol is a sulfadryl preparation and acts as a reducing agent. Sulphur is contained in many proteins and is largely deposited in the skin. In injuries and burns sulphur metabolism is disturbed. Sulfadryl apparently stimulates the production of enzymes for the synthesis of sulphur-containing animal acids.

Chas. A. Bahn.

Davids, B. **Effects of quanta-irradiation upon the eye.** Arch. f. Ophth. **148**: 617-642, 1948.

In this theoretical discussion shortwave irradiation is considered as a bombardment of the eye by single corpuscles. The changes seen in the cornea and the lens occur in foci. Single cells or smaller groups of cells are affected where radiation quanta impinge on vital structures, especially of the nuclei. Four groups of quanta-effects are enumerated: effects upon the cell plasma and the cell membrane, gene-mutations, inhibition of mitotic processes, and disturbance of the structure of the chromosomes. The need to visualize the microphysical nature of these effects of radiation is emphasized.

Ernst Schmerl.

Duke-Elder, S., Davson, H., and Maurice, D. M. **Studies on the intraocular fluids. II. The penetration of certain ions into the aqueous humour and vitreous body.** Brit. J. Ophth. **33**:329-338, June, 1949.

Thiocyanate penetrates from the blood into the aqueous humor and especially the vitreous body more rapidly than either sodium, potassium or monosaccharides. Thiocyanate and the monosaccharides diffuse into the vitreous body from all the vascularized tissue surrounding it. Sodium and potassium enter predominantly from the ciliary region. In studying the factors of cell membrane permeability it was found that transference from the blood into the chambers of the eye takes place through cell bodies and not intercellular spaces. The concentration of salts in the intraocular fluids is greater than can be accounted for by a process of simple ultrafiltration; a process of secretion may be postulated.

Orwyn H. Ellis.

Fitzhugh, O. G., and Buschke, W. H. **Production of cataract in rats by betatetralol and other derivatives of naphthalene.** Arch. Ophth. **41**:572-582, May, 1949.

Changes in the lens which were similar to those described in naphthalene poisoning in rats were produced by feeding B-tetralol. A large number of naphthalene derivatives were studied for their possible cataractogenic property. In addition to B-tetralol, 1,2,3,4-tetrahydro-2-naphthylpropionate and B-naphthylsalicylate were more potent as cataractogenic agents than was either naphthalene or B-naphthol; B-tetralol, parenterally administered, was more than twice as potent. Sulfhydryl compounds did not prevent the formation of cataract in rats fed B-tetralol.

Ralph W. Danielson.

Fontana, Giuseppe. **The action of emetine on the cornea.** Arch. di ottal. **52**:113-132, May-June, 1948.

The effect of this drug on the cornea was first studied just before the first world war but the studies were rather incomplete. Corneal lesions ranging from a diffuse irregular nebular clouding to ulceration have been noted. Experiments were made with solutions varying from 1 to 5 percent. A reaction was evident in a few hours and may have been toxic, or anaphylactic. Corneal hyperesthesia, pain, and lesions of corneal nerve endings were noteworthy. The author studied the effects of 2-percent emetine injected under the conjunctiva of the bulb or the tarsus conjunctiva, and retrobulbarly. The corneal changes in most of these rabbits appeared after 48 hours and this tissue returned to normal in about 12 days. The hypothesis of anaphylaxis should receive some consideration. Francis M. Crage.

Fontana, Giuseppe. **Action of prostigmin on intraocular tension and on the diameter of the pupil.** Arch. di ottal. **52**:165-181, July-Aug., 1948.

Research was carried out on three groups of rabbits and one group of patients with normal and glaucomatous eyes among which were 22 cases of acute glaucoma, 12 of chronic glaucoma, and 2 of hydrophthalmus. There was marked reduction in tension in practically all acute and chronic glaucoma within 24 hours. In all the pupil came down to 2 mm. No effect was seen in the hydrophthalmic eyes. In the animals an iris prolapse was often partially or completely reduced within 48 hours after prostigmin especially when injected subconjunctivally. Pilocarpine and eserine were not as effective. The use of prostigmin alone, and in association with eserine, is recommended in prolapsed iris after limbal injuries.

Francis M. Crage.

Fontana, Giuseppe. **Farmocain in ophthalmology.** Arch. di ottal. **52**:188-194, July-Aug., 1948.

This new anesthetic is p-butylaminobenzyl-diethylamine chloride. It is a white crystalline powder, odorless, bitter, and soluble in water and ethyl alcohol. Solutions of ¼, ½, 1, 2, and 3-percent strength were instilled into the conjunctival sac of rabbits and patients. In the normal human eye a 1-percent solution produced a slight burning, hyperemia, and anesthesia in one minute. Anesthesia lasted for twenty minutes. When repeated twice within twenty minutes, engorgement of the conjunctival vessels took place but there was no corneal damage, change in the size of the pupil, or ocular tension. Where ulcers, keratitis, or foreign bodies were present, the burning and hyperemia were slightly increased.

Francis M. Crage.

Fralick, F. B., and Kiess, R. D. **Use of antihistaminic drugs in control of atropine dermatitis and conjunctivitis.** Arch. Ophth. **41**:583-586, May, 1949.

Atropine sulfate may be continued after the development of atropine dermatitis and conjunctivitis, since the reaction is

controllable by concurrent antihistaminic therapy. Pronounced improvement with antihistaminic treatment was noted within forty-eight hours in 8 or 9 consecutive cases of atropine hypersensitivity. A combination of local and general antihistaminic therapy proved most effective. From this limited series, it would seem that the treatment of choice is a combination of oral administration of tripelennamine hydrochloride (pyribenzamine) and local use of diphenhydramine hydrochloride (benadryl). Ralph W. Danielson.

Heath, P., and Geiter, C. W. **Use of phenylephrine hydrochloride (neo-synephrine hydrochloride) in ophthalmology.** Arch. Ophth. **41**:172-176, Feb., 1949.

Phenylephrine is a valuable member of the group of drugs possessing sympathomimetic activity. It may be used as a decongestive agent for the conjunctiva or globe. As a mydriatic it is used for fundus examination, in breaking adhesions of the iris to the lens, in refraction, and in some intraocular operations. Phenylephrine is of value in infiltration anesthesia as a decongestive and antispasmotic, and to prolong the action of the anesthesia. A number of less common uses are listed. The rapid absorption of substantial amounts of the drug causes marked and hazardous increase of the blood pressure. However, when applied to the anterior segment of the eye there is no significant change in either blood pressure or intraocular pressure. No harmful effects on the ocular tissues or the blood vessels have been observed nor has sensitivity or delayed healing been reported.

John C. Long.

Huggert, A. **A further support to the hypothesis that Ascher's aqueous veins contain aqueous humor.** Acta ophth. **27**: 119-123, 1949.

The author dropped fluorescein into the conjunctival sac of patients with marked corneal erosions. When the aqueous was stained with the fluorescein previously localized aqueous veins were also filled with green fluid, and pressure on the eyeball was followed by an increased outflow of this fluid. The veins proximal to the point of entry of the aqueous veins remained unstained. In other eyes with a normal cornea the superficial conjunctival and episcleral vessels were stained, but pressure upon the eyeball was followed by an outflow of clear fluid.

Ray K. Daily.

Jahnke, W. **Does zinc sulfate act as an astringent?** Arch. f. Ophth. **148**:775-779, 1948.

From several observations in men and rabbits the author concludes that instillation of zinc sulfate acts as an irritant or stimulant of the ocular tissues, not as an astringent. Ernst Schmerl.

Kiss, F. **The blood circulation of the eye.** Szemészet **1**:1-20, 1949.

Branching and topography of the blood vessels of the eye were studied in completely injected human eyes and those of various animals. The vessel system of the ciliary body consists of two parts, the broad vessels of the ciliary processes and the narrow ones of the ciliary plexus in the region of the muscle. The first system serves the production of the aqueous humor, the latter its resorption. The ciliary plexus may be considered a second capillary region of the broad iris veins. The drainage system of the ciliary body and the canal of Schlemm have a right-angular bend with spiral course, so that drainage may be slightly retarded when the internal pressure is increased. Blood and aqueous circulation of the human eye are normally in labile balance, the latter is primarily regulated by the arterial afflux. In experiments the ciliary plexus proved

to be the most important region of resorption. Gyula Lugossy.

Klang, Gunnar. **Measurements and studies of the fluorescence of the human lens in vivo.** Acta ophth. Supplement 31, 1948.

This monograph with an extensive bibliography is a report of a comprehensive investigation extending over a period of four years at the Ophthalmic Clinic in Lund, on a quantitative determination of the fluorescence of the normal human lens in vivo. This study is a preliminary to a planned investigation to determine whether changes in lens fluorescence can be established in pathological states. While fluorescence of the lens has been the subject of many investigations, the data of which are tabulated by the author, the only quantitative study of lens fluorescence preceding this report is that of Vannas and Wilska in 1935; their method of quantitative determination does not permit a study of the spectral composition of the fluorescent light, and is not applicable to cataractous lenses or work on experimental animals. In the author's investigation fluorescence was produced by ultraviolet rays of wave-length 365 μ isolated by filtration from the radiation of a mercury vapor lamp. The intensity of fluorescence was measured by comparing the light with that of a standard fluorescent screen and interposing filters until the two lights appeared of the same intensity. The instruments, experimental set-up, the technique, the sources of error, and their controls, are described in detail. The material for the investigation comprises 95 male and 163 female eyes of healthy persons, and 216 male and 102 female eyes of clinic patients treated for affections which could have no effect on the corneal or lens fluorescence. The lens fluorescence was measured in 576 eyes of 316 persons, and the corneal fluorescence on 446 eyes of 253 persons. The beam of concentrated ultraviolet light in the lens in vivo or isolated is seen as a path of fluorescent light, which does not extend through the entire thickness of the lens but stops before it reaches the center. Since all parts of the lens fluoresce, the termination of the light path in the lens is due to the high absorption of ultraviolet by the lens; the visible path of fluorescence comes almost entirely from the anterior parts of the lens and from an anterior layer which becomes increasingly thinner with advancing age. The visible path of the fluorescent beam becomes shorter with age, because of the increased absorption of ultraviolet with age. The fluorescence of the lacrimal fluid is insignificant, and there is no fluorescence from the aqueous. Iris fluorescence was found to be greater in blue and less in brown than in green irises. The fluorescence of lens, cornea, and iris increases with age. The amount of blue in the fluorescent light from the lens increases relative to the amount of green with increasing age, and the amount of violet suffers a relative decrease. The fluorescent light contains an insignificant amount of red color. It was found that the fluorescence of lenses in the female is higher in summer and lower in winter. This seasonal variation also occurs in males but to a lower degree. There is probably a greater intensity of fluorescence of lenses in females than in males. No significant variation in fluorescence of the lens could be established relative to the refraction of the eye, refractive power of the cornea, color of the iris, or color of the hair. The author believes that the seasonal variations in fluorescence may be related to the amount of lactoflavin in the lens. While variations in fluorescence with different pathologic states of the lens will be reported in detail in a further study, it is reported here that a marked increase in fluorescence was observed in diabetic cataract at such an early stage of develop-

ment that no definite pathologic opacities could as yet be observed in the lens. However, in diabetics with incipient senile cataract no increase in fluorescence was found. (2 figures, 37 tables, 16 graphs.)

Louis Daily, Jr.

Monje, M. **The effect of helenien upon the dark adaptation.** Arch. f. Ophth. **148:** 679-705, 1948.

Helenien is a lutein palmitinic acid ester obtained from Tagetes patula. After taking 375 mg. of helenien a day by mouth over a period of two weeks the sensitivity of seven subjects increased four to eight times for a period of two to three months.

Ernst Schmerl.

Morone, G., and Andreani, F. **The behavior of the pupil under the action of some drugs after resection of the cervical sympathetic.** Riv. oto-neuro-oftal. **23**:250-258, July-Aug., 1948.

A report is made on the pharmacodynamic behavior of the pupil in Bernard-Horner's syndrome in rabbits. The changes in the pupil were obtained by instillation of drops of atropine, cocaine and adrenalin solution. In one group of animals the pupil was dilated after a sympathectomy at the level of the second cervical neuron of Foerster and in a second group after the extirpation of the superior cervical ganglion or Foerster's third neuron. The writers are specially interested in the experiments with the adrenalin. The results in the second group agreed with Foerster's but the dilatation of the pupil in the first group did not. To explain the mydriasis the authors postulate an inhibitory system in the sympathetic pathways of which some of the fibers could originate below the superior cervical ganglion, or that some fibers independent of the main trunk bring residual mydriatic stimuli from the second neuron to the dilator of the pupil.

Melchiore Lombardo.

Pirie, A. **Ox vitreous humour. 2. Hyaluronic acid relationships.** Brit. J. Ophth. **33**:271-283, May, 1949.

Studies of the physical state of hyaluronic acid in the ox vitreous and its chemical and structural relationships with the proteins of the vitreous are reported. This substance, a viscous polysaccharide, is probably concerned with the maintenance of the physical state of the vitreous body. It is found in the vitreous of all animals but perhaps in highest concentration in that of the ox. The author believes that the description of the vitreous as a tissue made up of a network of fibrils which are the prolongations of cells and permeated by a viscous fluid or jelly which easily flows out of it is justified. That there is no chemical union of the proteins with the acid is borne out by the fact that in washings with water the two are washed out at different rates and analysis of the compound which remains shows no union of the two. Hyaluronidase does not have the same destructive effect on hyaluronic in the intact vitreous as in the filtrate. It is assumed that the proteins in the vitreous help to maintain the aggregated hyaluronic acid and that the aggregated hyaluronic acid helps to maintain the vitreous structure.

Morris Kaplan.

Ross, E. J. **The formation of the intraocular fluids. Studies of the urea component of the aqueous humor.** Brit. J. Ophth. **33**:310-323, May, 1949.

The concentration of urea in the aqueous and vitreous is appreciably less than in the blood plasma. This phenomenon could result from a selective secretion of urea across the barrier, utilization of urea within the eye, or the existence of a continuous outflow of aqueous from the eye, so that the rate of drainage of urea from the eye would exceed the rate of its entry. The first two of these possibilities are studied in this paper. In animals the rate

of penetration of urea into the aqueous is consistently higher than into the vitreous. That there is no deficit of urea in the aqueous and vitreous was determined by frozen section. Experiments with lenses both in vitro and in vivo and with normal and aphakic eyes showed that the utilization of urea is much too small to account for the difference. By Barany's method of ligating one carotid artery it was shown that ultrafiltration takes no part in the formation of the intraocular fluids. The difference in intraocular and in plasma urea has not been explained.

Morris Kaplan.

von Sallman, L., Evans, T. C., and Dillon, B. **Studies of the eye with radiosodium autographs.** Arch. Ophth. **41**:611-626, May, 1949.

Radioautographic technics were applied to studies of the movement of Na^{24} in the eye. A Gross method is used for frozen slices and the microscopic method of Evans for thin paraffin sections of the eye. Phases in the penetration of the tracer substance from the blood into the fluids of the eye were made visible. The regions of the ciliary body and of the optic nerve were shown as the main portals of entry. Diffusion of Na^{24} in the vitreous and into the anterior chamber occurred at a rapid rate after intravitreal injection of the tracer. Its movement in the living eye exceeded that in the enucleated globe. The problem of absorption of electrolytes by the ciliary body was studied with Na^{24}; a conspicuous accumulation of the tracer was observed in the ciliary processes after intravitreal injection. The influence of an applied electric field on the movement of Na^{24} in the eye was made visible by radioautography.

Ralph W. Danielson.

Sondermann, R. **The relationship between intraocular pressure, pressure in the retinal vessels and pressure of the spinal fluid.** Klin. Monatsbl. f. Augenh. **114**:161-168, 1949.

The article is based on the author's theory that the intraocular pressure has its origin in increased pressure in the veins and capillaries in the uvea, which is the result of the impediment in the flow of blood through the narrow scleral channels of the vortex veins on the one hand and the small openings in the lamina cribrosa for the central retinal vein on the other hand. Progressive narrowing of these channels during the embryonic developments increases this intravenous pressure. The intraocular pressure itself compresses these channels and increases, thereby, the venous pressure. The pressure of the veins within the orbit is one of no significance for the pressure in the retinal veins. The pressure of the cerebrospinal fluid is normally negative in the skull and plays no part in originating the high venous pressure even though the vein passes through the subarachnoid spaces. The intraocular pressure prevents the signs of engorgement in the retinal veins, in spite of their high venous pressure. Intraocular and intracranial pressures are unrelated. An increase of the latter to a value greater than 4 mm., which is only possible under pathological conditions, will be a further impediment in the flow of venous blood and increase the intraocular venous pressure. One can deduce the intracranial pressure by measuring the intraocular venous pressure as well as the ocular tension under these abnormal conditions. (References.)

Max Hirschfelder.

Sorsby, Arnold. **Concentration in the aqueous of various sulphonamides after systemic administration.** Brit. J. Ophth. **33**:347-358, June, 1949.

Sulphonamide concentrations in the aqueous were determined after oral administration in rats and intravenous ad-

ministration in rabbits. In the rat, the highest concentration in the aqueous was given by sulphanilamide with successively lower readings for sulphamerazine, sulphamezathine, sulphadiazine and sulphathiazole. Seven hours after administration sulphamerazine gave the highest aqueous value with successively decreasing values for sulphamezathine, sulphanilamide, sulphadiazine and sulphathiazole. Assessment of the highest aqueous level as a percentage of the highest plasma level showed the highest value for sulphanilamide with successively lower values for sulphamerazine, sulphadiazine, sulphamezathine and sulphathiazole. In the rabbit the highest concentration in the aqueous was given by sulphadiazine with successively lower values for sulphamezathine and sulphamerazine. Sulphadiazine also proved to be the most persistent as assessed by the aqueous concentration at three hours. The highest aqueous plasma ratio was shown by sulphamezathine.

Orwyn H. Ellis.

De Vincentiis, M., and Santamaria, L. **The lipidic metabolism of the retina.** Ann. di ottal. e clin. ocul. **74**:523-530, Sept., 1948.

De Vincentiis and Santamaria report their study of the capacity of the rabbit's retina in vitro to oxidize butyric acid and its methylic and glyceric esters, and succinic acid and the corresponding monomethylic ester. They show that the retina has a lipidic metabolism corresponding to that of normal tissue, that is, it possesses the enzymatic systems of beta oxidation which are lacking in tumor tissue. It is suggested that the glycidic metabolism of the retina is normal in type and that the so-called neoplastic character which retinal tissue may show in vitro is due to alteration of the enzymes necessary for the aerobic desmolysis of glycides. (References.) Harry Messenger.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Balding, Grant. **Surgery for high degree of monocular astigmatism.** Eye, Ear, Nose and Throat Monthly **28**:276-283, June, 1949.

A corneoscleral section was made perpendicular to the axis of the astigmatism. Although iris prolapse occurred on the third day, six months later the vision was 20/20, astigmatism was slight and the patient was able for the first time to wear glasses. He had binocular vision without discomfort. Orwyn H. Ellis.

Barnes, C. K. **Voluntary dissociation of the accommodation and the convergence faculty.** Arch. Ophth. **41**:599-606, May, 1949.

Two very interesting case reports are given, and observations on the voluntary dissociation of the accommodation and convergence faculties are discussed. The first observation suggests that the psychic concept of the location of the horopter in space is primarily related to convergence, rather than to accommodation. It also suggests that the psychic magnification of near objects and minification of distant objects in excess of that based on the law of the square of the distance is predicated on convergence primarily, rather than on accommodation. The second observation involves an unusual case of fusion anomaly in which lifelong functional parallelism appeared to depend on alternation at or above the frequency of flicker. It is believed that this case may be evidence in favor of the theory of physiologic alternation as a basis of fusion. This may again revive the theory that strabismus occurs in persons who have defective synchronization of the paired oculoneural "stroboscopes." Ralph W. Danielson.

Gilbert, M., and Hopkinson, R. G. **The illumination of the Snellen chart.** Brit. J. Ophth., **33**:305-310, May, 1949.

Studies were made on 15 adults to determine the effects of illumination on the reading of the Snellen chart. The subjects presented all types of ametropia and some emmetropia and were tested with and without their correction. The tests were conducted in illumination of 0.1, 3, and 100 foot candles. Each increase was in a ratio of 30 to 1. The results were not as startling as might be expected. An increase in illumination of the order of 10 to 1 improved the acuity by only one line on the chart, yet standard illumination for the Snellen chart seems necessary.

Morris Kaplan.

Granstrom, K. O. **Transient myopia following the administration of sulfonamides.** Acta ophth. **27**:59-69, 1949.

A detailed description is given of seven cases of transient myopia, for a few days after the administration of sulfonamides. In one the drug was absorbed from a locally treated fistula. The changes in refraction were as high as six or seven diopters, and were identical in the two eyes. The refractive power of the cornea was unchanged. There was a decrease in the depth of the anterior chamber in two cases, and two had an aqueous flare which disappeared with the regression of the myopia. With objective stigmatoscopy it was possible to demonstrate that the refractive changes occurred axially.

Ray K. Daily.

Hartmann, E. **Heterophoria and the decentering of lenses.** Ann. d'ocul., **182**:301-305, April, 1949.

A patient was uncomfortable with reading glasses fitted exactly to her pupillary distance, but was quite comfortable with the same lenses in a wider frame. The exophoria for near was therefore partially corrected by the prismatic action of decentered lenses. Chas. A. Bahn.

Heinsius, E. **The examination of night vision with the nyctoscope.** Arch. f. Ophth. **148**:741-757, 1948.

In testing night vision, dark adaptation as well as visual acuity under diminished illumination should be examined. The author used phosphorescent Landolt rings or Snellen signs with definite optical qualities and measured the visual acuity in several thousand normal persons. With brightness per unit surface from about 10^{-6} to 10^{-5} stilb he finds the range of normal night vision to vary from 4 to 22 angular minutes. Ernst Schmerl.

Huggert, Arne. **The form of the iso-indicial surfaces of the human crystalline lens.** Acta ophth. Supplement 30, pp. 121, 1948.

This monograph, with an extensive bibliography, presents a detailed report of a four-year study carried out at the Ophthalmic Clinic in Stockholm, with the principal objectives of determining whether the surfaces of the lens or its iso-indicial surfaces have the wave-like course attributed to them theoretically by Gullstrand, and of explaining the genesis of the well-known phenomenon that a distant luminous point source of light is not perceived as a point only, but is surrounded by rays. Gullstrand, who made the most exhaustive study of this phenomenon, demonstrated that the refraction producing it is dependent upon a wave-like form of the lens surfaces or its iso-indicial surfaces. His opinion that this form could not be due to the anatomical structure, that is, the suture system of the lens, dates to a time when the complicated suture system of the adult lens nucleus was as yet unknown. Huggert, in this investigation tried 1. to ascertain radial ridges and valleys on the lens surfaces by slit-lamp examination and by examinations of the reflex images from the lens surfaces; 2. to determine the form of the iso-indicial surfaces by laboratory studies

of fixed and fresh human and cattle lenses; 3. to determine that the zones of optical discontinuity and iso-indicial surfaces in the lens are identical; and 4. to compare the shape of the star figure seen by subjective stigmatoscopy with the anatomical structure of the suture system of the anterior adult nucleus. Only the last investigation yielded definitely positive findings. Experimental errors and technical difficulties inherent in the methods employed in the first three problems tended to make their results inconclusive. No regular wave-like changes were found in the central parts of the anterior and posterior lens surfaces or their reflexes, and the findings in the peripheral portions were not certain. Direct laboratory examination of the form of the iso-indicial surfaces in fixed and fresh lenses justify the assumption that they are wave-like. A study of the correlation between the discontinuity zones of the lens and its iso-indicial surfaces indicates that within certain limits they are identical. However, slitlamp study of the surfaces and reflexes of the lens nucleus showed definitely that the adult nucleus surface has a fairly regular wavy form connected with the sutural system of the lens, and examination of fixed animal and human lenses demonstrated that the adult nucleus has 8 to 12 waves at the poles, and a larger although less distinct number near the equator. Comparative analyses of the correlation between the form of the star figures seen around small distant sources of light and the sutural figures of the lens nucleus prove the existence of such a correlation, and indicate that the form of star figures may be explained by the form of the nuclear surfaces. (27 figures, 20 tables.) Louis Daily, Jr.

Littmann, H. **The fundamentals of skiascopy.** Arch. f. Ophth. **148**:658-678, 1948.

A theory of skiascopy based upon the principles of geometric optics is presented. The skiascopic shadow should move freely over the whole pupillary area. Mirrors having a radius of from 15 to 20 mm. are preferred to the smaller ones used in electric skiascopes. The disturbances caused by the central hole can be avoided if a mirror without a hole in the glass is used. In order to determine the refraction of the foveal area, the patient should look into the direction of the examining eye. Ernst Schmerl.

Márquez, M. **The supposed torsions of the eye around the visual line in oblique directions of gaze.** An. Soc. mex. de oftal. **22**:1-21 (including discussion), 1948.

This highly technical optical paper does not lend itself to abstract, but leads to the following conclusion. The fundamental error in the interpretation of consecutive images in oblique directions of gaze has been a double one. On the one hand their inclination has been attributed to turning of the eyeball upon the visual line instead of attributing it to a pseudoturning upon an oblique axis continued in Listing's plane, and on the other hand one has confused the axes of the eye, which pass through the center of rotation and which play no part in this case, with the vertical and horizontal meridians of the retina, which pass through the center of the fovea whose inclination in the same direction of gaze determines the obliquity of the consecutive image by a mechanism which is purely one of geometric optics. (10 figures, references.) W. H. Crisp.

Ribas Valero, Ramon. **The relation of the interfocal circle of the conoid of Sturm to the retinal surface.** Arch. Soc. oftal. hispano-am. **9**:445-454, April, 1949.

This must be read completely.

Ray K. Daily.

Rivas Cherif, Manuel de. **High visual acuity with defective ocular refraction.** An. Soc. mex. de oftal. **22**:37-54, 1948.

The author, who is a loyal admirer of Márquez's ophthalmometric method of

testing for biastigmatism, found combined astigmatism of cornea and crystalline lens in 63.3 percent of 327 cases of refraction. He urges that study of refractive errors in school children and others should not be limited to those manifesting visual defects. (9 figures, references.)
W. H. Crisp.

Sloane, A. E. **The management of early presbyopia and bilateral aphakia.** Tr. Am. Acad. Ophth. pp. 352-56, March-April, 1949.

The substitution of separate distance and near glasses for bifocals may greatly facilitate ocular comfort. In the double vision which occasionally follows bilateral cataract extraction, glasses fitting one eye for distance and the other for near may be of material service. An illustrative case of each is described. Chas. A. Bahn.

Tarle, E. **Rehabilitation of skiascopy.** Ann. d'ocul. **182**:384-390, May, 1949.

The author advises the use of an electric retinoscope with flat parallel light at arm's length. A lens battery with half diopter intervals is also suggested.
Chas. A. Bahn.

5

DIAGNOSIS AND THERAPY

Ambrose, A. **A simplified perimeter of wall type.** Arch. Ophth. **41**:633-636, May, 1949.

The author describes this instrument which is cheap and takes up but little room because suspended from the wall.
Ralph W. Danielson.

Arruga, H. **The utilization of binocularity for experimental investigations in therapy.** Arch. Soc. oftal. hispano-am. **9**: 349-351, April, 1949.

To assess the value of new therapeutic agents Arruga uses them on one eye, while the other one serves as a control. In this manner he determined the ineffectiveness of agents proposed for the arrest of cataracts, of various ointments for blepharitis, and of Filatov's tissue therapy in retinitis pigmentosa and myopic retinopathy. Ray K. Daily.

Basterra, J. **Tissue therapy in ophthalmology.** Arch. Soc. oftal. hispano-am. **9**: 424-444, April, 1939.

Fifteen cases of retinal detachment, recurrent hemorrhage of the vitreous, retinitis pigmentosa, diabetic retinitis, senile macular degeneration, stubborn allergic conjunctivitis and tuberculous iridocyclitis, in which injections of cod liver oil, implantation of placenta, and injections of placental extract had no beneficial effect are briefly reported. Ray K. Daily.

Cogan, D. G., and Grant, W. M. **Treatment of pediculosis ciliaris with anticholinesterase agents.** Arch. Ophth. **41**:627-628, May, 1949.

For the treatment of pediculosis ciliaris the time-honored ammoniated mercury has proved itself effective. Yet it is of considerable interest to know that the common physostigmine in the standard concentrations used for the treatment of glaucoma is just as effective. Tetraethylpyrophosphate, and presumably many other anticholinesterase compounds, are also effective. A case in which the authors had an opportunity to study the effect of physostigmine and tetraethylpyrophosphate is reported. Ralph W. Danielson.

Hallerman, W. **Operative risk and sudden increase in intraocular pressure.** Klin. Monastbl. f. Augenh. **114**:144-148, 1949.

Sudden voluntary upward movements of the patient's eye lead to a considerable pull on the superior rectus muscle with subsequent rise in pressure. They should not be blindly counteracted by a superior rectus suture. A slight "give" in the pull is indicated. An injection of novocaine into the superior rectus muscle is recom-

mended for patients who are expected to be uncooperative or to press their lids together. (3 figures.) Max Hirschfelder.

Krimsky, E. **A new hand slitlamp.** Tr. Am. Acad. Ophth. pp. 357-358, March-April, 1949.

An ordinary flashlight handle is used with two plano-convex lenses and a slit diaphragm properly adjusted. A supplementary magnifying lens is supported by a bracket. Chas. A. Bahn.

Krimsky, E. **Concealed glare filters of supplementary lenses.** Tr. Am. Acad. Ophth. pp. 359-360, March-April, 1949.

Plastic glare filters are attached by a hinge to the temples of Zylonite frames. Each is approximately 1 cm. vertically and extends from the temple to the nose piece of each eye. Being hinged, the filters may be swung forward and nasally before the patient's vision, or backwards where they are concealed along the temples. Chas. A. Bahn.

Krimsky, E. **Ferris-wheel attachment to Brewster type of stereoscope.** Tr. Am. Acad. Ophth. pp. 360-361, March-April, 1949.

A series of stereoscopic pictures are mounted on circular discs so that they may be rotated into the viewing position. By means of handles, these discs can be laterally regulated for ocular convergence or divergence. Chas. A. Bahn.

Krimsky, E. **Clear-view lens frame for the Brewster stereoscope.** Tr. Am. Acad. Ophth. p. 361, March-April, 1949.

To facilitate ocular inspection especially in stereoscopic training in esotropia the author has constructed a lens frame in which the nasal sides of the frame are omitted. Chas. A. Bahn.

Lepri, Giuseppe. **Rheumatic diseases of the eye.** Arch. di ottal. **52**:133-163, May-June, 1948.

The author investigated the effect of salicylic acid injections (Mester diagnostic technique) on three groups of patients. His studies included a fourth or control group. From his studies he concluded that this diagnostic test was rather limited in its value with regard to ocular disease, but showed some cutaneous action of theoretical importance in rheumatic persons. Francis M. Crage.

Losada Garcia, Jesus. **Details of photographic technic applied to retinography.** Arch. Soc. oftal. hispano-am. **9**:459-474, April, 1949.

The author describes in detail the characteristics of the various emulsions, types of films and filters, and development techniques suitable for retinography in visible and infrared light. (5 tables, 3 formulas.) Ray K. Daily.

Mata Lopez, Pedro. **Antibiotic therapy of ocular tuberculosis.** Arch. Soc. oftal. hispano-am. **9**:415-423, April, 1949.

The literature on streptomycin is reviewed. Ray K. Daily.

Miller, H. A. **The intraocular application of penicillin.** Ann. d'ocul. **182**:378-383, May, 1949.

Recommended only in panophthalmitis, 5,000 to 10,000 units of penicillin in 0.1 to 0.2 cc. of solution is injected into the vitreous. Prolonged, severe pain follows. For infected ulcers injection into the aqueous is preferred and 0.2 to 0.3 cc. of aqueous is removed and an equal amount of penicillin solution is substituted. The injection of penicillin into Tenon's capsule with scarification of the sclera is less drastic than injection into the vitreous and apparently more effective than injections into the anterior chamber. The intraocular injection of penicillin is of uncertain value in uveitis of unknown origin and is definitely contraindicated if a tuberculin reaction is positive.

Chas. A. Bahn.

Moore, J. I. **An evaluation of the use of beta rays in ophthalmology.** South. M. J. **41**:1092-1094, Dec., 1948.

This paper summarizes the results of the Radium Clinic of the Wilmer Institute of the Johns Hopkins Hospital. In the past nine years beta rays have been used in the treatment of a variety of ophthalmological conditions. Almost all beta rays are absorbed by the first 3 mm. of tissue. Obviously this form of therapy is suitable only for superficial lesions of the skin of the lids, conjunctiva, cornea and sclera. The beta ray applicator used consists of a glass bulb, 5 mm. in diameter, containing radon, enclosed by brass except for the open end through which the unfiltered beta rays emerge. This active portion of the applicator is attached to a handle 35 cm. long. The side walls and end toward the operator contain sufficient brass to exclude all the beta rays, but not the gamma rays. The beta and gamma rays unfiltered pass through the open end.

Beta ray therapy is the treatment of choice in vernal conjunctivitis, vascularization of the cornea following ulcers, chemical burns, trauma or keratitis and tuberculous keratitis, and epitheliomas of the cornea and limbus. Pterygia, papillomata of the skin, warts, granulation tissue of lids and globe, keloids of lids, and heavy scarring of conjunctival flaps following glaucoma surgery are successfully treated with beta rays, but may also be treated with other types of therapy. Dense old corneal scares without vascularization, dark pigmented moles of the lids, sebaceous cysts, chalazion and xanthelasma are not helped by beta ray therapy. Theodore M. Shapira.

Neerdam, H., and Lawoetz, B. **Chemotherapy in perforating injuries of the eye.** Acta ophth. **27**:69-73, 1949.

On the basis of a shortened stay in the hospital and delayed and less frequent indications for enucleation in 147 perforating ocular injuries, the authors conclude that prophylactic sulfonamide therapy is effective in inhibiting intraocular infection. Ray K. Daily.

Scholtyssek, H. **Sanatorium treatment for tuberculosis of the eye in the flat country?** Klin. Monatsbl. f. Augenh. **114**:97-105, 1949.

The author reviews the results of sanatorium treatment in ocular tuberculosis and points out favorable results obtained in the German institution Walsrode, which is situated in a relatively low altitude. Climatic therapy of not too great an intensity is apparently desirable and the results equal those obtained in higher altitudes. (References.)

Max Hirschfelder.

Shoemaker, R. E. **Intravitreal use of streptomycin.** Arch. Ophth. **41**:629-632, May, 1949.

Intravitreal injection of streptomycin was used clinically in a case of bacterial endophthalmitis and appears to be a safe procedure when indicated. Unfavorable effects on the vitreous were practically nil. Retinal degeneration occurred, as in experimental animals, but one could minimize this by not exceeding the recommended dosage (800 micrograms per injection). Ralph W. Danielson.

Stevenson, W. **An applicator for beta radium D.** Tr. Am. Acad. Ophth. p. 366, March-April, 1949.

The radium container is attached to two movable arms. The more distal is attached to any speculum. Thus the radium can be placed and held in any desired position without manual support.

Chas. A. Bahn.

Stevenson, W. **A new eye needle holder.** Tr. Am. Acad. Ophth. p. 367, March-April, 1949.

The author uses a spring forceps simi-

lar to the Beaupre lash forceps as a needle holder. Chas. A. Bahn.

Thorpe, H. E. **Lens for deep vitreous examination.** Tr. Am. Acad. Ophth. pp. 362-363, March-April, 1949.

To facilitate more detailed examination in some types of retinal detachment and posterior vitreous abnormalities, the author modified the −55 D lens of Hruby. A hard rubber mounting which fits into an ordinary trial frame is used to prevent lashes touching the lens and also to avoid lens scratching. Reflections are minimized by lens coating. Chas. A. Bahn.

Thorpe, H. E. **Electrified suction tip.** Tr. Am. Acad. Ophth. p. 363, March-April, 1949.

To prevent annoying oozing of blood in scleral surgery the author has placed an electric screw tip connection on a suction tube. By turning on the diathermic current with the foot switch a bleeding point is at once dried and electrically coagulated. Rubber gloves are worn to insulate the operator from the diathermic current.

Chas. A. Bahn.

Thorpe, H. E. **Aperture slide for binocular ophthalmoscope.** Tr. Am. Acad. Ophth. p. 363, March-April, 1949.

To avoid dazzling light reflexes with the binocular ophthalmoscope, on opaque semi-circular stop is substituted for the filters. This covers the lower half of one eye and the upper half of the other.

Chas. A. Bahn.

Thorpe, H. D. **Modified Kalt electrified needle holder for inserting micropins in retinal detachment surgery.** Tr. Am. Acad. Ophth. p. 364, March-April, 1949.

The lock catch and spring were removed from the ordinary stainless steel Kalt needle holder and an electric connection was placed on the back end of the handle. Thus the needle holder may be used in retinal detachment surgery for different types of micropins. Rubber gloves are worn by the operator.

Chas A. Bahn.

6

OCULAR MOTILITY

Abraham, S. V. **Etiology of nonparalytic strabismus.** Ann. West. Med. and Surg. **3**:115-125, April, 1949.

The author reviews the literature on the etiology. The comparative anatomy is well presented with illustrations. The convergence mechanism is late in evolution and is still comparatively immature in the individual. The accommodation-convergence mechanism is also studied. The causal factor in nonparalytic strabismus is an interference with convergence and this functional unit determines the anatomic position of rest of the eyes. The fusion faculty is normally weak in the formative years. Orwyn H. Ellis.

Carreras Duran, B. **Internuclear paralysis.** Arch. Soc. oftal. hispano-am. **9**:359-366, April, 1949.

A woman, 56 years old, is described, who had a paralysis of the right internus when looking toward the left, but not in convergence. The differential diagnosis of the various central lesions to be considered is discussed in detail.

Ray K. Daily.

Drucker, A. P. **Cyclic or rhythmic oculomotor paralysis.** Eye, Ear, Nose and Throat Monthly **28**:274-276, June, 1949.

A child with cyclic or rhythmic oculomotor paralysis is described and the literature reviewed. Exotropia and unilateral ptosis were also present.

Orwyn H. Ellis.

Johnson, W. F. **A surgical approach to the inferior oblique muscle.** Arch. Ophth. **41**:607-610, May, 1949.

After the eye is pulled far nasally, an

incision is made parallel to the external rectus muscle and extended along its lower border to the lateral fornix.

Ralph W. Danielson.

Lloyd, I. **Recession of the inferior oblique.** Brit. J. Ophth. **33**:291-296, May, 1949.

In both vertical and horizontal imbalance of the eyes the action of the inferior obliques must be studied adequately. As many as 53 percent of convergent squints in children were associated with a vertical defect and 30 percent were characterized by overaction of the inferior oblique. The vertical defect must also be corrected to achieve the desired cosmetic and functional result. The indications for reducing overaction of the inferior oblique are presented. Measured recession of the muscle is always done. Partial and complete tenotomy are dismissed as unreliable. The transconjunctival route is used and the external rectus either moved aside with a hook or severed if it is to be operated upon also. The oblique is recessed 6 to 9 mm. and reattached horizontally just below the lower border of the external rectus. Twelve cases in which results were uniformly good are reported.

Morris Kaplan.

Oaks, I. W. **Divergence insufficiency as a practical problem.** Arch. Ophth. **41**: 562-569, May, 1949.

Divergence insufficiency is a definite clinical entity characterized by esophoria which is greater for distance than for near. It occurs, in some degree, in more than 10 percent of all patients with binocular vision who are refracted. The cause is unknown, but there seems no reason why the condition should not occur from the same causes that produce other imbalances of the horizontally acting muscles. Symptoms include headache (not relieved by correction of refractive errors), ocular fatigue and occasional diplopia, nausea, dizziness, blurring of distant vision and panoramic headache. Diagnosis is made by use of screen-prism tests, prism duction measurements and lateral vergence tests at the near point. The relation of convergence and divergence at the near point are found not to conform to statements in some textbooks. Treatment is best accomplished by 1. proper refraction, 2. increase in the plus sphere correction, 3. use of base-out prisms, when accepted, 4. orthoptic training, and 5. surgical intervention.

Ralph W. Danielson.

Piper, H. F. **Concomitant strabismus.** Arch. f. Ophth. **148**:555-616, 1948.

The author studied the phorias, fusion, depth perception and retinal correspondence in a small number of patients. Concomitant strabismus is a pathologic entity. The controlling cortical areas are weakened. Subcortical centers regulate the motor functions of the binocular unit. In horizontal strabismus the subcortical stimuli are associated with impulses for the accommodation of the single eye. In vertical strabismus the impulses are linked to stimuli for the upward and outward rotation of each eye during sleep.

Ernst Schmerl.

Remky, H. **Changes of the sensory apparatus in strabismus.** Arch. f. Ophth. **148**:725-740, 1948.

The author studied a number of patients with stereoscope and perimeter. Usually a more or less pronounced central scotoma of the squinting eye could be demonstrated even in cases with bilateral amblyopia. A nervous disturbance, probably in the area of the vestibular nucleus, is suggested as the primary cause of strabismus. Ernst Schmerl.

Urrets Zavalia, Alberto, Jr. **Disturbances of the vertical ocular muscles.** An. Soc. mex. de oftal. **22**:237-262, 1948.

The author recognizes four groups of these disturbances: 1. pure concomitant vertical deviations; 2. acquired paralysis of the vertical muscles; 3. congenital unilateral or bilateral insufficiencies of the vertical muscles; and 4. dissociated vertical deviations. The first class is extremely rare or non-existent. Bielschowsky's explanation of dissociated vertical deviations is the only logically adequate one. (20 figures, chiefly clinical; references.)

W. H. Crisp.

7

CONJUNCTIVA, CORNEA, SCLERA

Arques Girones, Emilio. **Superficial punctate kerato-conjunctivitis.** Arch. Soc. oftal. hispano-am. **9**:287-292, March, 1949.

The author believes that punctate keratoconjunctivitis is a neuritis of the terminal subepithelial corneal nerves, which spreads through Bowman's membrane. Since the corneal epithelium and Bowman's membrane are related embryologically to the conjunctiva they could be involved with it in a process which originates in the respiratory passages and ascends on the nasal and lacrimal mucous membrane. The characteristic piercing pain is due to the involvement of the corneal nerves and the opacities develop in Bowman's membrane at the points where it is perforated by the nerves. Occasionally the opacities extend deeper into the corneal parenchyma. Ray K. Daily.

Cameron, E. H. **The treatment of hypopyon ulcer of the cornea.** Brit. J. Ophth. **33**:368-371, June, 1949.

Since the introduction of sodium sulphacetamide for the treatment of corneal abrasions in miners in Scotland the incidence of hypopyon ulcer has been greatly reduced, and the number of severe ulcerations has likewise decreased. No eye has been lost in the last seven years. In a series reviewed in 1931 there was a 10-percent loss. Improved prophylaxis and earlier treatment of minor injuries undoubtedly played a part.

Orwyn H. Ellis.

Chavarria, F. A. **Simplification of pterygium surgery.** Arch. Soc. oftal. hispano-am. **9**:454-458, April, 1949.

Chavarria describes his procedure as simple and efficacious. He thoroughly dissects the head of the pterygium from the cornea, continues for four millimeters over the sclera, and then cuts the pterygium off with straight scissors, perpendicular to its fibers. The eye is bandaged, without sutures. Ray K. Daily.

Cogan, D. G. **Principles of corneal pathology: hydration properties of the cornea.** An. Soc. mex. de oftal. **22**:87-98, 1948.

This is a statement, in Spanish, of material already published in English by the author. It is part of a continuing series in the Anales. W. H. Crisp.

Cogan, D. G. **Principles of corneal pathology: III. Epithelial edema and related conditions: A, epithelial edema.** An. Soc. mex. de oftal. **22**:167-174, 1948.

See preceding title. W. H. Crisp.

Fierro del Rio, Leonel. **Endocrinologic studies of spring conjunctivitis.** An. Soc. mex. de oftal. **22**:54-71, 1948.

Of 33 patients with vernal conjunctivitis studied, 22 showed endocrine disorders by simple physical exploration. The other patients were normal except as to the ocular disturbance. All with endocrine disturbance had gonadal insufficiency. The author believes that disturbed interaction between the sex gland and the pituitary produces a condition similar to allergy. W. H. Crisp.

Friede, R. **Megalocornea congenita, a phylogenetic anomaly.** Arch. f. Ophth. **148**:761-774, 1948.

A case of congenital megalocornea and

theoretical considerations concerning its genesis are presented. The differentiation between megalocornea and hydrophthalmus is emphasized. Ernst Schmerl.

Gasteiger, H. **Rodent ulcer of the cornea and corneal changes in scleroperikeratitis (Szilly).** Klin. Monatsbl. f. Augenh. **114**:112-126, 1949.

The author observed rodent ulcer in six patients 42 to 75 years of age. Three eyes were examined histologically. Some of the patients were well-nourished and otherwise healthy; one had advanced necrosis of the sclera. Various forms of scleritis and episcleritis with involvement of the cornea are described for comparison. There is no doubt of the inflammatory character of the lesion; it is not a carcinoma-like epithelial process or trophoneurotic change. The etiology is varied; marginal ulcers, acne of the cornea, small corneal injuries, scleritis and episcleritis as well as beginning degenerative processes may be the beginning from which a rodent ulcer finally develops, if certain constitutional characteristics are favorable to its formation. (1 color plate, 8 figures, references.) Max Hirschfelder.

Harbater, M. **Scleromalacia perforans: report of a case.** Arch. Ophth. **41**:183-187, Feb., 1949.

A case of scleromalacia perforans and the pathologic findings in one enucleated eye are described. The clinical appearance of the lesion and the pathologic features conformed closely to the description by Verhoeff and King. The disease accompanied chronic rheumatoid arthritis of long standing and, in the course of about twenty months, slowly progressed to involve most of the anterior portion of the sclera in a necrotizing process. The eyes have become blind as a result of an accompanying uveitis. An unusual feature of this case was an associated marginal necrosis of the cornea. John C. Long.

Huggert, H. **Is the embryotoxon corneae posterior Axenfeld an error in development of Schlemm's canal?** Arch. f. Ophth. **148**:780-786, 1948.

Two cases of embryotoxon corneae are reported. Whereas some authors ascribe the embryotoxon to the persistence of mesodermal tissue between iris and cornea, the author regards this condition as a displaced Schlemm's canal.

Ernst Schmerl.

Klein, M. **The lacrimal strip and the precorneal film in cases of Sjøgren's syndrome.** Brit. J. Ophth. **33**:380-388, June, 1949.

The precorneal film consists of a deep mucoid layer, an intermediate lacrimal watery layer, and a thin oily layer. This is for the protection of the eye and is responsible for the brightness of the corneal surface. In kerato-conjunctivitis sicca there was a decrease in lacrimal secretion although the marginal strips of lacrimal fluid and precorneal film were present. The precorneal film seemed to be composed of the usual three elements, but the mucoid component predominated.

Orwyn H. Ellis.

Llorca Perez. **Two cases of bilateral crystalline dystrophy of the cornea.** Arch. Soc. oftal. hispano-am. **9**:280-286, March, 1949.

Two paracentral annular opacities of the cornea, consisting almost entirely of small iridescent needle-like crystals, are reported. One patient, 12 years old, developed the opacities at the age of six. The other, a sailor, noticed them while in the service. In both the center and an area adjacent to the limbus were entirely transparent. There were no inflammatory phenomena, and no blood vessels. The arrangement of the crystals was parallel in the first case, and irregular in the other; they were in the anterior parenchymal layers. General examinations were nega-

tive, except for a slight hypercholesterolemia. The literature on fatty corneal dystrophy, and the lipoid metabolism of the cornea is reviewed. (4 figures.)

Ray K. Daily.

Meyer, F. W. **Critical report on eighteen corneal transplantations.** Klin. Monatsbl. f. Augenh. **114**:131-140, 1949.

Both homoplastic and autoplastic corneal tissue may be used. The use of the latter gives no assurance of a clear transplant and is not superior to the former. Discs which were obtained as late as 42 hours post mortem from the donor eye remained clear. The status of the cornea into which the transplant material is implanted is the most important factor in the subsequent course. Clear and healthy corneal islands are a prerequisite for successful transplantation. When the first implant becomes opaque, a repetition of a transplant with a second disc is recommended. When there is a difference in the level of the endothelium between the cornea of the host and the implant, scar tissue is apt to develop. On the epithelial side the differences in level disappear.

Max Hirschfelder.

Ravn Sorensen, C. H. **A case of primary conjunctival tuberculosis.** Acta ophth. **27**:113-118, 1949.

In a woman with Parinaud's conjunctivitis biopsy suggested Boeck's sarcoid and culture from the tissue revealed tubercle bacilli of the human type. Since no other tuberculous focus was revealed, the tuberculosis of the conjunctiva was assumed to be primary. The diagnostic difficulties of ocular tuberculosis are discussed. (3 figures.) Ray K. Daily.

del Rio, L. F., and Aupart, D. A. **Endocrinologic studies in spring conjunctivitis: III. Determination of urinary 17-ketosteroids.** An. Soc. mex. de oftal. **22**: 107-111, 1948.

Determination of the elimination in the urine of these hormonal substances was made in a group of patients with spring conjunctivitis. The figures were normal in children of less than twelve years, but below normal in patients of greater age. In this latter group the findings were regarded as significant of a gonadal lesion. In six men examination of spermatic fluid and of testicular biopsies indicated a manifest lesion of the testicle. (References.) W. H. Crisp.

Sédan-Bauby, S., Sédan, J., and Payan, H. **Corneas conserved in ice.** Ann. d'ocul. **182**:364-377, May, 1949.

To determine the best method of preserving corneal transplants, the authors study four series of enucleated eyes of dogs. Those preserved in ice with humid air 24 hours after death developed massive desquamation of the epithelium with bullae on the fifth day. In those similarly preserved immediately after death the same changes took place in nine days. When the eyes were preserved in citrated autoblood, necrosis of the basal membrane was noted on the ninth day. In the fourth series paraffin oil was used as a preservative; bullae were visible on the seventh day. The anterior epithelium was least destroyed when the enucleated eyes were immediately placed in paraffin oil.

Chas. A. Bahn.

Silva, D. **Epidemic keratoconjunctivitis in Mexico.** An. Soc. mex. de oftal. **22**:131-140, 1948.

Numerous outbreaks of this disorder occurred in the Mexican capital between February and April, 1947, after return of the Mexican laborers who worked in the United States during the war. The number of cases was apparently at its height in August, 1947. Sixty-eight cases are discussed from the author's experience. The article includes five excellent photomicrographs showing epithelial cell inclusions.

It is recommended that the disease be included in the list of those whose notification is required by law. W. H. Crisp.

Sommer, G. **Total transplantation of the cornea.** Klin. Monatsbl. f. Augenh. **114**:126-131, 1949.

The author reports operative procedure and course in a case of total transplantation of the cornea in a patient with an extensive total staphyloma of the cornea. A sudden opacification of the donor cornea occurred on the nineteenth day, possibly as a result of an anaphylactic tissue reaction. The eye finally had light perception and perception of handmovements. Max Hirschfelder.

Starke, H. **Primary tuberculosis of the conjunctiva.** Klin. Monatsbl. f. Augenh. **114**:107-112, 1949.

The author reviews the differential diagnosis of Parinaud's syndrome. The importance of bacteriological investigation and animal inoculation is stressed. Biopsy in a nine-year-old boy revealed tuberculous infiltration of the conjunctiva. The preauricular gland became necrotic and tubercle bacilli were found in material obtained by aspiration. Two similar cases of primary conjunctival tuberculosis are also reported. (References.)
Max Hirschfelder.

Tavolara, L. **The gonioscopic picture of embryotoxon corneae posterius.** Boll. d'ocul. **28**:91-100, Feb., 1949.

This congenital anomaly, described and named by Axenfeld in 1920, has been studied gonioscopically only by Busacca in 1948. Two of Tavolara's patients were siblings. All eyes had gonioscopically visible strands originating from different levels of the iris periphery and inserted into the opaque area of the limbus or in the brilliant streak which marked the internal border of the embryotoxon. The strands, "goniosynechiae," are ascribed by Tavolara to a prolonged contact between the posterior corneoscleral surface and the iris which, in all cases, was hypoplastic and had but few crypts in the areas near the limbal opacties. Although embryotoxon may be a developmental anomaly the author also considers the possibility of intrauterine inflammatory disease a possible cause. (9 figures, references.) K. W. Ascher.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Arjona, L. **Observations on dyschromias of the iris.** Arch. Soc. oftal. hispano-am. **9**:397-404, April, 1949.

The biochemistry of the pigment elements of the eyeball, and a description of the changes which they undergo in glaucoma, diabetes, diseases of the liver, and senility are reviewed. The increase of iris pigment in association with malignant tumors of the eyeball, and melanosis of the globe in Sturge-Weber's disease are examples of hyperpigmentation. A case of choroidal sarcoma in which a pigmented focus in the iris, which had always been there, became denser and darker with the development of the intraocular tumor, is reported to demonstrate the effect of an adjacent pigmented malignant process on the metabolism of pigment cells. The increased activity of the pigment cells can be attributed either to an increase of dopa oxidase which extended beyond its source or to a cellular disturbance, which expressed itself in an increased production of dioxyphenylalanin. (2 figures.) Ray K. Daily.

Bocci, G. **Recurrent iritis with hypopyon.** Boll. d'ocul. **28**:32-40, Jan., 1949.

This disease was termed ophthalmia lenta or septic iridocyclitis by Gilbert, and recurrent uveitis due to staphylococcus allergy by Weve. The author's pa-

tient was a three-year-old boy with corneal perforation and traumatic cataract due to an explosion which also caused multiple skin lesions with secondary pyogenic infection. One week after the injury hypopyon developed and disappeared in five days with sulfonamide therapy. During the following weeks there were three recurrences. (References.)

K. W. Ascher.

Cavara, V., and Di Ferdinando, R. **Sympathetic ophthalmia and herpetic infection.** Boll. d'ocul. **28**:1-16, Jan., 1949.

Two men, aged 40 years had recurrent herpetic keratouveitis of one eye only. After 16 years in one patient and five months in the other, a severe deep uveitis with keratitis developed in the previously normal fellow eye. In both cases, the first eye was enucleated and one of them was examined histologically; it showed typical sympathetic ophthalmia. Similar observations have been reported of "sympathetic" involvement after herpes zoster in the other eye. These patients, however, present the first cases of sympathetic ophthalmia after herpes febrilis of one eye. (10 photomicrographs, references).

K. W. Ascher.

Magitot, A. **Trichloracetic acid and iris prolapse.** Ann. d'ocul. **182**:216-218, March, 1949.

Local application of trichloracetic acid in saturated solution is advised in old and recent iris prolapse with or without conjunctival covering and in some corneal injuries in which vitreous prolapse interferes with wound healing. It is preferred to galvanocautery which requires greater anesthesia. The cauterization may be repeated at two or three-day intervals for two or three weeks. Penicillin ointment is subsequently used. Chas. A. Bahn.

Rossi, Giuseppi. **A case of bilateral exudative choroiditis with retinal detachment and meningeal symptoms. (Harada's disease).** Arch. di ottal. **52**:218-230, July-Aug., 1948.

The author reports a case of this disease, first described by Harada of Japan and so rare in Caucasians, that occurred in a young white woman in generally excellent health. The extension of the process to the anterior uveal tract was the only change which bore a relationship between this and the Vogt-Kojanagj syndrome. Another case under observation began like Coats's disease but later took on the aspects of both the Harada and Vogt-Kojanagj syndromes. The author assumes that these syndromes are different expressions of one disease which is probably infectious. Francis M. Crage.

Vergara, L., Ramírez, A., and Bolaños, F. A. **Penetrating wounds of the eyeball. Intraocular foreign bodies. Sympathetic ophthalmia.** An. Soc. mex. de oftal. **22**:21-37, 1948.

Upon a review of 25 patients with penetrating wounds of the eyeball, in two of which the eyeball was enucleated after unsuccessful attempt at removal of an intraocular foreign body, and a consideration of the various theories put forward by different authors with regard to the etiology of sympathetic ophthalmia, the author speculates as to whether a nonspecific iritis prepares the field for a virosis or whether the dominant factor is sensitization to uveal pigment. (15 figures, 5 pp. references.) W. H. Crisp.

PAN-AMERICAN NOTES

Edited by MANUEL URIBE TRONCOSO, M.D.
500 West End Avenue, New York 24, New York

Contributions should reach the editor by the 12th of the month

BRAZIL

SOCIEDADE DE OFTALMOLOGIA DE MINAS GERAES

The following officers were elected to serve during 1949-1950: President, Prof. Hilton Rocha; vice-president, Dr. Geraldo Queiroga; secretary, Dr. Oswaldo de Cervalho; treasurer, Dr. José Tarcísio de Castro; librarian, Dr. Ary Alvares Pires.

SOCIEDADE DE OFTALMOLOGIA DE SÃO PAULO

The following officers were chosen to serve during 1949-1950: President, Dr. Plinio Toledo Piza; vice-president, Dr. Manoel A. da Silva; general secretary, Dr. Avelino Gomes da Silva; 1st secretary, Dr. Artur Amaral Filho; treasurer, Dr. Aureliano Fonseca; files, Dr. João Carneiro.

CHILE

SOCIEDAD CHILENA DE OFTALMOLOGÍA

At its first meeting for 1949, this society reëlected the officers who had served during the past year, as follows: President, Prof. Italo Martini; vice-president, Prof. Cristobal Espildora Luque; secretary, Dr. Adrian Araya Costa; pro-secretary, Dr. Hernán Brinck; treasurer, Dr. Rene Contardo.

MEXICO

The post-graduate department of the University of Mexico announces the second series of lectures on ophthalmology. The course will last three weeks and will include lectures, demonstration of patients, and practical training in ophthalmoscopy, perimetry, campimetry, angioscotometry, tonometry, and gonioscopy.

The course will deal especially with internal diseases of the eye, including the optic nerve and vitreous. In addition, there will be lectures and demonstrations in surgery of the eye—detachment of the retina, surgery of intraocular cysticercus, surgery of the eyeball, exenteration of the globe, Mules's operation, and so forth, as well as surgery of intraocular tumors. The course will end with practical lectures on the pathology of the eye (the technique of pathologic anatomy was studied in the first series of the course). In this second series, the student will learn by projections of microscopic sections the pathology of the internal diseases.

In addition to the General Hospital, the following institutions will coöperate: Hospital of La Luz, Hospital of the Association for the Prevention of Blindness, and the services of ophthalmology of the Juarez military and children's hospitals. The course is under the direction of Dr. M. Puig Solanes, professor of ophthalmology, University of Mexico, with the coöperation of a group of physicians of the other institutions. Enrollment price is 350 pesos.

SOCIETIES

JOINT MEETING OF PAN-AMERICAN ASSOCIATION AND N.S.P.B.

At a meeting of the executive committee of the Pan-American Association of Ophthalmology, held in New York City on May 7, 1949, it was decided to hold an interim meeting at the same time and place as the 1950 annual meeting of the National Society for the Prevention of Blindness. The dates set were March 26th to 30th and the place Miami Beach, Florida, with headquarters at the Floridian Hotel.

The following tentative program was drawn up:

Sunday, March 26th. Registration and cocktail party.

Monday, March 27th. A joint meeting of the two organizations, with the opening session at approximately 10 o'clock. The first scientific paper will be a résumé of the accomplishments of the committee on the prevention of blindness of the Pan-American Association of Ophthalmology. Dr. A. Vazquez Barriere (Montevideo, U.) is chairman. The second scientific paper, by Dr. Anderson will be on the rice diet and hypertension. This is to be discussed by Dr. Kempner. At noon there is to be an informal buffet luncheon. In the afternoon there will be a fuller discussion of the committee on the prevention of blindness, with representatives of the different countries represented on the committee speaking in the alphabetical order of those countries.

Tuesday, March 28th. Tuesday morning will be devoted to a program of the Pan-American Association of Ophthalmology: Dr. Albert D. Ruedemann (United States), "The prevention of blindness in industry from the medical standpoint"; Dr. Jorge Valdeavellano (Peru) "Observation of the effect of sunlight on the eyes"; Dr. Robison Harley and Dr. Robert Peckham (United States), "The effect of sunlight on retinal sensitivity." The fourth paper is to be a report of the committee on teaching of ophthalmology on the prevention of blindness, by Dr. Cecil O'Brien (United States) and Dr. Alberto Urrets Zavalia (Cordoba, Argentina). Tuesday afternoon will be devoted entirely to a program of the National Society for the Prevention of Blindness.

Wednesday, March 29th. In the morning the program will be arranged by the National Society for the Prevention of Blindness. In the afternoon the program, under the auspices of the Pan-American Association of Ophthalmology, will include: "Military ophthalmology in the prevention of blindness," Dr. Victor Burns, Admiral Swanson, and Colonel Stone; "Trachoma clinics," Dr. Magin A. Diez (Brazil) and Dr. Cosgrove.

Thursday, March 30th. In the morning there will be a "Glaucoma symposium" under the auspices of

the Pan-American Association of Ophthalmology. It was decided to limit this symposium to secondary glaucoma. The following division of the subject was tentatively agreed upon: Secondary to cataract; secondary to uveitis; secondary to trauma; and congenital glaucoma. The moderator is to be Dr. Conrad Berens.

Personals

Dr. Lijó Pavia of Buenos Aires has been invited to give a course this month in Mexico City on photography of the retina in black and white and color. Dr. Pavía will also speak on and demonstrate the ophthalmoscopy of the fundus with red-free light, yellow light, and other lights.

NEWS ITEMS

Edited by Donald J. Lyle, M.D.
601 Union Trust Building, Cincinnati 2

News items should reach the editor by the 12th of the month but, to receive adequate publicity, notices of postgraduate courses, meetings, and so forth should be received by the editor at least three months before the date of occurrence.

Deaths

Dr. Eugene Orr, Nashville, Tennessee, died May 18, 1949, aged 60 years.

Dr. Homer Jonas Rhode, Reading, Pennsylvania, died June 3, 1949, aged 71 years.

Dr. William D. Rowland, Boston, Massachusetts, died July 1, 1949.

Miscellaneous

Clearing house for publications

Later this year, the UNESCO Clearing House for Publications plans to publish a manual on the international exchange of publications and, as a supplement to this manual, a classified list of libraries, universities, scientific institutions, learned societies, and so forth throughout the world which are willing to exchange either their own publications or other publications regularly at their disposal.

All institutions which have not, as yet, sent to UNESCO details of their exchange material are urged to communicate the following information to the UNESCO Clearing House for Publications, 19 Avenue Klebrt, Paris 16e: (1) Name and full address of institution, (2) exact titles of publications offered, (3) conditions under which exchange will be made.

This information must reach UNESCO by October 1, 1949.

Societies

AOS officers

Officers of the American Ophthalmological Society elected at the recent meeting are: President, Dr. Parker Heath, Boston; vice-president Dr. John H. Dunnington, New York; secretary-treasurer, Dr. Maynard C. Wheeler, New York.

New York Society officers

The New York Society for Clinical Ophthalmology has elected the following officers for the coming year: President, Dr. Sidney A. Fox; vice-president, Dr. Samuel Gartner; recording secretary, Dr. Bernard Kronenbeg; corresponding secretary, Dr. Leon H. Ehrlich; treasurer, Dr. Edward Saskin; librarian, Dr. Howard Agatston. The retiring president, Dr. Benjamin Esterman, was elected to the advisory council.

Cincinnati Ophthalmologic Club

During the school year 1948-49, the Cincinnati Ophthalmologic Club held nine meetings at which the following subjects were discussed: "Principles of extraocular muscle surgery," Dr. Hermann Burian, Boston; "Demyelinating diseases of the central nervous system with associated ophthalmic findings," Dr. McIntyre, Cincinnati.

"Industrial responsibility of the ophthalmologist," Dr. Hedwig S. Kuhn, Hammond, Indiana; "The differential diagnosis of the acute glaucomas," Dr. Peter C. Kronfeld, Chicago; "Reparative surgery," Dr. Alston Callahan, Birmingham; "Surgical anatomy of glaucoma operations," Dr. F. Bruce Fralick, Ann Arbor, Michigan; "Surgical treatment of hypermature cataract," Dr. Derrick Vail, Chicago; "Medical treatment of glaucoma and its pharmacologic basis" Dr. Harold G. Scheie, Philadelphia; "Medical treatment of ocular tuberculosis," Dr. G. B. Bietti, Pavia, Italy.

At the final meeting of the year, the following officers were elected: President, Dr. Donald J. Lyle; vice-president, Dr. K. W. Ascher; vice-president and secretary, Dr. D. J. Weintraub.

Reading meeting

On June 22nd, at the 94th meeting of the Reading Eye, Ear, Nose, and Throat Society, Dr. Frank D. Costenbader, Washington, D.C., was guest of honor. He spoke on "Pediatric ophthalmology." Other speakers were Dr. Maurice Saltzman and Dr. Matthew S. Ersner of Philadelphia, and Dr. Frederick Vastine and Dr. Harold L. Strause of Reading.

Personals

To give Gifford Lecture

Dr. John Dunnington, New York, will deliver the sixth annual Sanford R. Gifford Lecture on January 16, 1950, at Chicago.

Toronto appointments

The University of Toronto faculty of medicine has appointed Dr. H. L. Ormsby clinical teacher in charge of eye bacteriology, and Dr. O. B. Richardson clinical teacher in charge of eye pathology.

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Ophthalmologica

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